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EMERSON'S SECOND PART

THE

NORTH AMERICAN

ARITHMETIC.

PART SECOND,

UNITING

ORAL AND WRITTEN EXERCISES.

PHILADELPHIA:
LIPPINCOTT, GRAMBO & CO.
1853.

Educ T 118.53.350 (II)

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THE

NORTH AMERICAN

ARITHMETIC.

PART SECOND,

UNITING

ORAL AND WRITTEN EXERCISES,

IN

CORRESPONDING CHAPTERS.

BY FREDERICK EMERSON,
LATE PRINCIPAL IN THE DEPARTMENT OF ARITHMETIC,
BOYLSTON SCHOOL, BOSTON.

PHILADELPHIA:
B. F. JACKSON.
1853.

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June 5, 1953

Orders of the School Committee of Boston.

At a Meeting of the School Committee, Nov. 18, 1834.

Ordered, That Emerson's North American Arithmetic, Second nd Third Parts, be substituted in the Writing Schools, for Colburn's First Lessons and Sequel.*

Ordered, That the Arithmetics now in use be permitted to their present owners; but that whenever a scholar shall have occasion to purchase a new one, the North American Arithmetic shall be required.

Attest, S. F. M'CLEARY, Secretary.

* The First Part was already adopted by a previous order.

A KEY to this work, containing solutions and answers [a small book for Teachers only,] is published separately.

PREFACE.

This book is intended for the use of scholars who have been taught in 'Part First,' or by some other means have learned to add, subtract, and multiply numbers as high as 10, mentally.

The whole *Course of Exercises*, of which this is the *Second Part*, has been divided into three parts, more for the sake of economy and convenience, than on account of any natural division of the subject. The work is not intended to be a *record of the science*,—such as might befit the pages of an encyclopedia,—but, a *system of induction*, through which the scholar may be led to the discovery of arithmetical truth, and the proper application of arithmetical operations. *Rules*, and the technical language necessary to their composition, are avoided in the early part of the course—they are not introduced until the learner is supposed prepared, by intellectual improvement from previous lessons, to meet them understandingly.

In the arrangement of the exercises in this volume, I have been governed by the natural order of the science; believing, that any deviation from that order, with a view of rendering the work more *immediately practical*, would render it in reality *less practical*, as it would necessarily lead the scholar into a habit of performing operations, without comprehending the principles which justify them. The first six chapters consist of oral exercises, and the last six of correspondent written exercises. The work may therefore be viewed as two entire systems of arithmetic—*Oral* and *Written*.

Although Part Second does not complete the series of books, entitled 'The North American Aritametic,' still it contains the essential principles, and the common application of the science. Scholars, therefore, who shall be properly conducted through this volume, will have acquired a knowledge of Arithmetic, adequate to all the purposes of common business. Part Third is designed for those, whose continuance at school shall afford opportunity for prosecuting a more extended course of study

The mode of teaching arithmetic, and the text-books, used for the purpose, in a great portion of our country, are radically defective. Much of arithmetic is *practised* at school, but little is *learned*. The scholar is put to *ciphering* without adequate mental preparation, and is referred to the direction of *rules*, whose phraseology and principles are to a learner equally obscure. By a tedious course of practice, perhaps he acquires a certain mechanical dexterity in performing operations; but no sooner does he enter upon the business of life, than he abandons the rules of his book, and, *in his own way*, learns so much of arithmetic as his occupation requires.

Whether the following treatise is calculated to afford any remedy for the defects I have alluded to, others will decide. I shall spare myself the task of a prefatory detail of what "*the author conceives*" to be its advantages, and will only add, that the design and execution of the work, have cost me much time and labor.

F. Emerson.

Boston, January, 1832.

NOTE TO TEACHERS.

It will be most advantageous for *young* scholars, to go through with all the Oral Arithmetic before they enter upon the Written Arithmetic. Older scholars, however, after performing the exercises in the first chapter of Oral Arithmetic, may pass immediately to the exercises in the first chapter of Written Arithmetic: and after concluding this chapter, may take up the two second chapters in the same order; and thus proceed through the book.

Much time has been wasted in some of our schools, by the practice of teaching *individually*, instead of teaching *in classes*. If this practice has been owing in any degree to the arrangement of text-books, it is hoped the present arrangement will afford a remedy. There can be no more objection to a distinct classification of a school for the purpose of teaching arithmetic, than there is to a like classification for the purpose of teaching orthography: and the advantages of class-instruction in the former branch, are as great as those in the latter.

The examples contained in the first six chapters, do not require the use of the slate. The answers, with the process of obtaining them, and the reasons which justify the process, are to be given orally. For example, the following question may be supposed to give rise to the subjoined exercise.

Example. A trader purchased 9 barrels of flour, at 7 dollars a barrel, and sold the whole for 68 dollars. What did he gain in the trade? *Pupil.* 'He gained five dollars.' *Teacher.* 'How do you perceive it?' *Pupil.* 'If one barrel cost seven dollars, nine barrels must have cost nine times seven dollars, which is sixty-three dollars. He must have gained the difference between sixty-three dollars and sixty-eight dollars. 63 from 68 leaves 5.'

Learners should not be confined to any form of expression in solutions—their reasoning should be *their own*. By a little practice, they will acquire an astonishing acuteness of apprehension, and facility of expression.

ORAL ARITHMETIC.

CHAPTER I.

NUMERATION.

SECTION 1.

WHEN we have a large number of articles to count, such as quills, nuts, cents, &c., we may, if we please, count them by *tens*. Let us suppose we have a quantity of cents before us, and proceed to count them as follows.

We first count out *ten* cents, and lay them in a pile We then count out ten more, and lay them in another pile; then ten more for another pile; and thus we continue to count out ten at a time, until we have counted ten piles. We put these ten piles together, and they make a large pile containing *One Hundred* cents.

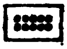
Again we count out ten cents at a time, until we have counted ten small piles, as before. We put these together, and they make a large pile containing one hundred, like the hundred we first counted. We have now counted two hundred cents, and they lie in two large piles.

Having learned what is meant by *two hundreds*, we proceed to count out one hundred cents more; and after placing them by the side of the two hundreds, the three piles make three hundreds. Four large piles will be four hundreds; five piles will be five hundreds; six piles will be six hundreds; seven piles will be seven hundreds; eight piles will be eight hundreds; nine piles will be nine hundreds; and when we have counted out ten of these piles, we put the whole together. They make a pile still larger, and the number of cents contained in it is *One Thousand*.

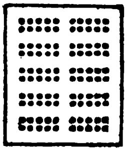
Examine the arrangement of dots enclosed in the lines below, and find how many there are in each enclosure. Observe, that the figures standing over the several enclosures, represent the number of dots contained therein.

1

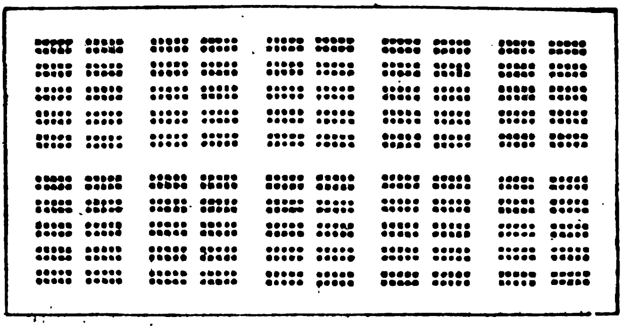
10



100



1000



Example 1. Which of these numbers is the greatest, *One*, or *Ten*, or *One Hundred*, or *One Thousand*?

2. How many ones are there in a ten?

3. How many tens are there in a hundred?

4. How many hundreds are there in a thousand?

5. Ten *ones* make what number? Ten *tens* make what number? Ten *hundreds* make what number?

6. What figures stand to represent the number ten?

7. What figures stand to represent one hundred?

8. What figures stand to represent one thousand?

Section 2.

If one hundred scholars were in school, and one scholar more should come in, the number of scholars would then be one hundred and one; and would be expressed in figures thus;—101. Again, if you had one hundred books, and you should buy two books more, you would then have one hundred and two books, and their number would be expressed in figures thus;—102.

In Part First, you learned to read figures expressing all numbers, from *One* to *One Hundred.* You will now see, in the following columns, how the figures stand to express numbers, from *One hundred*, to *Two hundred.*

100	One hundred,
101	one hund. and one,
102	one hund. and two,
103	one hund. and three,
104	one hund. and four,
105	one hund. and five,
106	one hund. and six,
107	one hund. and seven,
108	one hund. and eight,
109	one hund. and nine,
110	one hund. and ten,
111	one hund. and eleven,
112	one hund. and twelve,
113	one hund. and thirteen,
114	one hund. and fourteen,
115	one hund. and fifteen,
116	one hund. and sixteen,
117	one hund. and seventeen,
118	one hund. and eighteen,
119	one hund. and nineteen,
120	one hund. and twenty,
121	one hund. and twenty-one,
122	one hund. and twenty-two,
123	one hund. and twenty three,
130	One hund. and thirty
140	One hund. and forty.
150	One hund. and fifty.
160	One hund. and sixty.
170	One hund. and seventy
180	One hund. and eighty.
190	One hund. and ninety.
200	Two hundred.

Edward's mother gave him one hundred walnuts, his sister gave him sixty, and his brother gave him eight; making together, one hundred and sixty-eight. Being required to tell what figures would express the number of his walnuts, Edward looked over the columns of figures on the last page, and discovered, (as you may), that 1 means *one hundred*, whenever two figures are standing at the right hand of it; and, that 6 means *sixty*, whenever one figure is standing at the right hand of it. He therefore said, "1, 6, 8, are the figures."

1. How many tens does the figure 6 represent, when there is one figure standing at the right of it?
2. What are 6 tens usually called, in reading numbers?
3. How many tens does the figure 4 represent, when there is one other figure standing at the right of it?
4. What are 4 tens usually called, in reading numbers?
5. What number does the figure 1 represent, when there is one other figure standing at the right of it?
6. What number does the figure 1 represent, when there are two other figures standing at the right of it?
7. What are 1 hundred and 5 tens usually called?
8. What are 1 hundred and 9 tens usually called?
9. What are 1 hundred and 3 ones usually called?
10. What are 1 hundred and 8 ones usually called?
11. What are 8 tens and 2 ones usually called?
12. What are 1 hundred, and 7 tens, and 5 ones usually called, in reading numbers?

Note to Teachers. Require the learners to read the numbers expressed in the following columns, without recourse to the preceding columns.

109
127
145
163
181
118
136

172
190
121
143
165
187
154

104
110
132
155
176
198
186

168
140
122
195
177
159
131

113
147
169
183
103
125
158

The comparisons on the next page will show you, that all the hundreds are expressed in the same manner that one hundred is expressed.

100	One hundred.	133	One hund. & thirty-three.
200	Two hundred.	633	Six hund. & thirty three.
106	One hund. & six.	149	One hund. & forty-nine.
306	Three hund. & six.	749	Seven hund. & forty-nine.
117	One hund. & seventeen.	154	One hund. & fifty-four.
417	Four hund. & seventeen.	854	Eight hund. & [illegible].
121	One hund. & twenty-one.	199	One hund. & ninety-nine.
521	Five hund. & twenty-one.	999	Nine hund. & ninety-nine.

Note to Teachers. The learners may be required to read the several numbers expressed in the following columns of figures.

814	293	552	466	851
372	947	444	664	767
528	381	786	391	579
451	619	369	940	296

CHAP. II.

ADDITION.

Section 1.

1. The Humane Society gave Charles a premium of 6 dollars, for saving a boy from drowning, and a lady gave him 5 dollars more. How much did he receive?

Solution. 6 dollars and 5 dollars are 11 dollars.

2. A merchant sold 7 barrels of flour to one man, and 5 to another. How many barrels did he sell?

3. If you should pay 9 cents for a book, and 4 cents for a pencil, how much would you pay for both?

4. A farmer paid 10 dollars for a plough, and 9 dollars for a harrow. How much did he pay for both?

5. A baker bought 8 barrels of flour of a merchant, and 8 more of a miller. How many did he buy?

6. Thomas gave 9 cents for a purse, and had 7 cents left to put in it. How many cents had he at first?

7. A farmer sold 5 cows, and then had 6 cows left How many cows had he at first?

8. If you should receive 9 dollars from one man, and 5 from another, how many dollars would you receive?

SECTION 2.

1. Two little boys went into a shop to be weighed. The oldest of them weighed 40 pounds, and the youngest, 30 pounds. How many pounds would they weigh both together?

Solution. 40 is the same as 4 *tens*, and 30 is the same as 3 *tens*. Then 4 tens and 3 tens are 7 tens;—and 7 tens are the same as 70.

2. There were 40 oranges in one basket, and 20 in another. How many were there in both baskets?

3. What is the whole number of scholars in a school, that consists of 20 boys and 30 girls?

4. A baker paid 50 dollars for a horse, and 30 dollars for a cart. How many dollars did he pay for both?

5. If I read 50 pages of history, and 40 pages of poetry, how many pages do I read of both?

6. If a man has lived 20 years in the city, and 10 years in the country, how old must he be?

7. James paid 60 cents for his Reader, and 40 for his Arithmetic. How many cents did they both cost?

8. Suppose you should buy 60 quills at one store, and 50 at another; how many quills would you have?

Solution. 60 is 6 tens, and 50 is 5 tens. 6 tens and 5 tens are 11 tens. 11 tens are 1 hundred and 1 ten;—that is, 110.

9. Suppose 70 books are upon my table, and I put on 50 more; how many will then be on the table?

10. If a gold watch cost 90 dollars, and the chain 40 dollars; how many dollars do they both cost?

11. In a certain orchard, there are 80 pear trees and 60 peach trees. How many trees in the orchard?

12. If 90 persons should enter a hall at one door, and 60 at another; how many would there be in the hall?

13. If I purchase 80 barrels of flour from one man, and 80 from another; how many barrels shall I have?

14. A miller had 90 bags of wheat on hand, and received 80 bags more. How many bags had he then?

15. If a horse cost 90 dollars, and a gig 90 dollars, how much do the horse and gig both cost?

16. How many pounds of honey in two jars;—there being 70 pounds in one jar, and 60 in the other?

SECTION 3.

1. A gardener called three boys to the garden gate to give them some grapes. To the first boy he gave 40 grapes, and to the second 40; but the third boy attempted to push the others aside, and the gardener seeing it, gave him only 6. How many did he give them all?

Solution. 40 grapes and 40 grapes are 80 grapes. Then 80 grapes and 6 grapes are 86 grapes.

2. John, James, and Henry went a fishing. John caught 30 fishes, and James caught 40; but Henry caught only 9. How many did they all catch?

3. How many are 30 and 40 and 9?

4. A traveller gave 70 dollars for his horse, 20 dollars for his saddle, and 5 dollars for his bridle. How many dollars did he give for the whole?

5. How many are 70 and 20 and 5?

6. A farmer kept 50 sheep in one pasture, 30 in another, and 7 in another. If he had kept them all in one pasture, how many would there have been together?

7. How many are 50 and 30 and 7?

8. How many cents will it take to buy a seal, a blank-book, and a pencil; supposing the seal to cost 60 cents, the blank-book 20 cents, and the pencil 8 cents?

9. How many are 60 and 20 and 8?

10. An escort went out to meet Gen. Layfayette: 40 men rode on horseback, 30 rode in gigs, and 10 rode in coaches. Of how many did the escort consist?

11. How many are 40 and 30 and 10?

12. How many are 40 and 30 and 3?

13. How many are 60 and 20 and 5?

14. How many are 30 and 30 and 7?

15. How many are 50 and 40 and 9?

16. How many are 50 and 50 and 8?

17. How many are 60 and 40 and 4?

18. How many are 70 and 30 and 6?

SECTION 4.

1. A certain class consists of 11 studious boys, and 2 dle boys. How many are there in the class? 13.

2. How many are 11 and 2? 11 and 3? 11 and 4? 11 and 5? 11 and 6? 11 and 7? 11 and 8? 11 and 9? 11 and 10? —

3. Alfred paid 11 cents for a pen-knife, and 10 cents for a writing-book. How much did he pay for both? 21.

4. If you should pay 12 cents for a slate, and 3 cents for an orange, how many cents would they both cost? 15.

5. How many are 12 and 2? 12 and 3? 12 and 4? 12 and 5? 12 and 6? 12 and 7? 12 and 8? 12 and 9? 12 and 10? —

6. If 12 boys play at foot-ball on one side, and 8 boys on the other, how many are there in the play? 20.

7. A certain class consisted of 13 small boys, and 4 large boys. How many were there in the class? 17.

8. How many are 13 and 2? 13 and 3? 13 and 4? 13 and 5? 13 and 6? 13 and 7? 13 and 8? 13 and 9? 13 and 10? —

9. A number of sheep are in a fold;—13 are lying down, and 6 are standing up. How many are there? 19.

10. There were 14 hats hanging up, and 5 more lying down. How many hats were there in all? 19.

11. How many are 14 and 2? 14 and 3? 14 and 4? 14 and 5? 14 and 6? 14 and 7? 14 and 8? 14 and 9? 14 and 10? —

12. If you give 14 cents for a bow, and 4 cents for an arrow, how much do the bow and arrow cost? 18.

13. A wagoner drove 15 miles in the forenoon, and 6 in the afternoon. How many miles in the day? 21.

14. How many are 15 and 2? 15 and 3? 15 and 4? 15 and 5? 15 and 6? 15 and 7? 15 and 8? 15 and 9? 15 and 10? —

15. If a cow be worth 15 dollars, and a sheep 2 dollars, what are the cow and sheep together worth? 17.

16. David wrote 16 lines in the forenoon, and 7 in the afternoon. How many lines did he write in the day? 23.

17. How many are 16 and 2? 16 and 3? 16 and 4? 16 and 5? 16 and 6? 16 and 7? 16 and 8? 16 and 9? 16 and 10? —

18. A trooper gave 16 dollars for his saddle, and 9 dollars for his bridle. How much did he pay for both 25

19 A man lost 8 dollars, and still had 17 dollars left How many dollars had he before he lost any? 25

20 How many are 17 and 2? 17 and 3? 17 and 4? 17 and 5? 17 and 6? 17 and 7? 17 and 8? 17 and 9? 17 and 10?

21. If a time-piece cost 17 dollars and a looking-glass 7 dollars, how many dollars do they both cost? 24

22. While 18 doves were upon a roof, 9 doves more lit among them. How many were then upon the roof? 27

23. How many are 18 and 2? 18 and 3? 18 and 4? 18 and 5? 18 and 6? 18 and 7? 18 and 8? 18 and 9? 18 and 10?

24. A man rolled 18 barrels of flour out of a mill and a boy rolled out 5 more. How many did both roll out? 23

25. A young man began studying law at the age of 19 years, and studied 3 years. At what age did he finish? 22

26. How many are 19 and 2? 19 and 3? 19 and 4? 19 and 5? 19 and 6? 19 and 7? 19 and 8? 19 and 9? 19 and 10?

27. A farmer mixed 19 bushels of oats with 10 of corn. How many bushels were there of the mixture? 29

Note to Teachers. The following combinations may be embraced in separate questions by the teacher; thus,—*How many are* 19 *and* 4?

19 and 4	23	14 and 2	16	19 and 9	28	15 and 9	24
16 and 3	19	19 and 6	25	16 and 8	24	13 and 7	[illegible]
18 and 5	23	16 and 6	[illegible]	13 and 5	18	14 and 4	18
12 and 2	14	15 and 4	[illegible]	18 and 8	[illegible]	14 and 8	[illegible]
17 and 7	27	18 and 2	20	14 and 6	20	12 and 5	[illegible]
19 and 7	26	17 and 6	[illegible]	12 and 9	21	14 and 7	[illegible]
15 and 5	20	19 and 3	[illegible]	13 and 3	16	17 and 8	[illegible]
19 and 8	27	16 and 5	21	12 and 7	19	12 and 6	18
17 and 9	26	15 and 8	23	16 and 6	22	16 and 9	[illegible]
12 and 8	20	16 and 4	20	17 and 5	22	13 and 8	[illegible]

SECTION 5.

1. Charles had 25 books in his library, and his father gave him 8 more. How many had he then? 33

Suggestion. You will easily perceive how many 25 and 8 are, since you already know that 5 and 8 are 13, and that 15 and 8 are 23.

2. A father said to his son, 'You are 7 years old, and I am 47—How old shall we each of us become, in 9 years from this time?' What should have been the answer? 16. 56.

3. James bought a small book for 6 cents, and David bought a large book for 56 cents. For how many cents must each boy sell his book, in order to get 4 cents more than he gave? 10. 60.

4. Julia was returning from a walk in the garden, with 8 red roses, and 68 white roses. She met her brother, who gave her 6 more red roses, and 6 white ones. How many of each kind had she then? 14. 74.

5. William has 9 cents, and John has 79 cents. If they should each of them get 10 cents more, how many would each boy then have? 19. 89.

Note to Teachers. The following combinations may be embraced in questions by the teacher; thus,—*How many are* 3 *and* 9?

3 and 9 12
13 and 9 22
7 and 6 13
27 and 6 33
8 and 8 16
38 and 8 46
1 and 7 8
41 and 7 48
54 and 6 60
67 and 8 75
72 and 9 81
85 and 7 92
90 and 5 95
18 and 4 22
26 and 7 33
39 and 2 41
41 and 10 51
53 and 9 62
65 and 6 71
77 and 3 80
89 and 5 94
92 and 7 99
14 and 10 24
26 and 7 33
38 and 8 46
41 and 7 48
53 and 9 62
65 and 2 67
77 and 10 87
89 and 6 95
92 and 4 96
14 and 8 [illegible]

SECTION 6.

1. A trader paid 29 dollars for a chest of tea, 4 dollars for a box of lemons, and 5 dollars for a box of raisins What did he pay for the whole? 38.

2. How many are 29 and 4 and 5? — 38.

3. If I pay 38 dollars to one man, 6 to another, and 3 to another, how many dollars do I pay out? 47.

4. How many are 38 and 6 and 3? — 47.

5. Stephen had 47 books; he bought 5 more, and then his uncle gave him 6 more. How many had he at last 58.

6. How many are 47 and 5 and 6? — 58.

7. On a certain day, a passenger travelled 56 miles in the stage, 4 miles in a wagon, and 7 miles on foot. How many miles did he travel on that day? 67.

How many are 56 and 4 and ˉ? — 60

9. If a yoke of oxen be worth 65 dollars, a sheep 2 dollars, and a lamb 2 dollars, how much are they all worth? 70.

10. How many are 65 and 8 and 2? — 75.

11. A school boy paid 74 cents for a reading book, 7 cents for a writing book, and 9 cents for some quills. How many cents did he pay for the whole? 90.

12. How many are 74 and 7 and 9? — 90.

13. A meeting was held in a country village, to which 83 persons walked, 9 rode on horseback, and 8 rode in gigs. How many attended the meeting? 100.

14. How many are 83 and 9 and 8? — 100.

15. A market man received 92 dollars for butter, 9 dollars for cheese, and 5 dollars for poultry. How many dollars did he receive for the whole? 106.

16. How many are 92 and 9 and 5? — 106.

SECTION 7.

1. The captain of a steam-boat received the following passengers;— 45 gentlemen, 20 ladies, and 8 children. How many passengers were there in all? 73.

Solution. 45 and 20 are 65; then 65 and 8 are 73. *Answer*, 73 passengers.

2. If a quire of paper cost 23 cents, a book 30 cents, and a pencil 9 cents, what do they all cost? 62.

3. How many are 23 and 30 and 9? — 62.

4. Alfred paid 25 cents for his penknife, and 20 cents for his wallet, and then had 5 cents left. How many cents had he at first? 50.

5. How many are 25 and 20 and 5? — 50.

6. A lady gave 57 cents for a fan, 30 cents for a work bag, and 4 cents for some needles. How many cents did she lay out? 91.

7. How many are 57 and 30 and 4? — 91.

8. A fowler went out one morning to shoot birds;— he shot 46 plovers, 50 snipes, and 6 quails. How many birds did he shoot? 102.

9. How many are 46 and 50 and 6? — 102.

10. If a cart cost 26 dollars, a plough 10 dollars, and a chain 5 dollars, what do they all cost? 41.

11. How many are 26 and 10 and 5? — 41

12. A farmer sold a horse for 75 dollars, a cow for 30 dollars, and a sheep for 5 dollars. How many dollars did he get for the whole? 110.

13. How many are 75 and 30 and 5? —110.

14. William gave 64 cents for a handkerchief and 40 cents for a pair of gloves, and then had 9 cents left How many cents had he at first? 113.

15. How many are 64 and 40 and 9? — 113.

16. How many are 5 and 9 and 2 and 8 and 6 and 4? —34.

17. How many are 8 and 3 and 7 and 6 and 5 and 3? —32.

18. How many are 6 and 8 and 4 and 9 and 7 and 5? —39.

19. How many are 9 and 7 and 2 and 8 and 3 and 6? —35

20. How many are 17 and 5 and 0 and 9 and 6 and 8? —45

21. How many are 23 and 8 and 1 and 0 and 9 and 7? —48.

2. How many are 48 and 6 and 7 and 4 and 0 and 2? —67.

23. How many are 71 and 3 and 9 and 0 and 6 and 9? —98.

CHAP. III.

SUBTRACTION.

Section 1.

1. There were 9 passengers in a stage; 3 of them got out to walk: how many remained in the stage? 6.

Solution. 3 from 9 leaves 6. *Answer.* 6 passengers.

2. A boy having 10 cents, paid 6 cents for a kite, and lost the remainder. How much did he lose? 4.

3. Ann has 12 books and Julia has 7. How many more must Julia have, to make her number equal to Ann's? 5

4. Andrew has 11 cents, and James has only 5 cents. How many cents has Andrew more than James? 6.

5. Stephen has 8 cents, and wishes to buy a knife worth 16 cents. How many more cents does he want? 8.

6. A lady went to buy goods, carrying 13 dollars; she returned with 9 dollars. How much did she spend? 4.

A merchant bought a box of goods for 10 dollars and sold it for 14 dollars. How much did he gain? 4.

8. Jonathan is 7 years old, and his brother is 11 years old. What is the difference in their ages? 4.

9. Henry bought a book and a pencil for 19 cents: he gave 10 cents for the book; what did the pencil cost? 9,

10. A man who owed a debt of 12 dollars, paid 5 dollars of it. How many dollars remained unpaid? 7,

11. John sold a knife for 18 cents, which was 9 cents more than he gave for it. How much did he give for it? 9,

12. A farmer agreed to give 17 dollars for a cow: and he paid 8 dollars down. How much did he still owe? 9,

SECTION 2.

1. A sloop of war went out with a crew of 70 men, and fell into an engagement, in which 30 of her men were killed. How many of the crew were still living? 40.

Suggestion. Consider the numbers to be, 7 *tens*, and 3 *tens*;—you may then take 30 from 70 as easily as you can take 3 from 7.

2. A market woman had 60 oranges, and sold 20 of them. How many had she remaining? 40.

3. 20 from 60 leaves how many? *How many are 20 and 40?* 40

4. A certain school consists of 50 scholars, 30 of whom are girls. How many boys are there? 20.

5. 30 from 50 leaves how many? *How many are 30 and 20?* —

6. A baker had 80 dollars to lay out for a horse and cart. After having paid 50 dollars for a horse, how many dollars had he left to purchase the cart? 30.

7. 50 from 80 leaves how many? *How many are 50 and 30?* —

8. If your lesson for the whole day be 40 questions in this book, and you answer 20 questions in the forenoon, how many are there left for the afternoon? 20.

9. 20 from 40 leaves how many? *How many are 20 and 20?* —20

10. I have read 40 pages, in a book which contains 90 pages. How many pages remain to be read? 50.

11. 40 from 90 leaves how many? *How many are 40 and 50?* —

12. James had 70 cents, and paid 40 of them for a school-book. How many cents had he left? 30.

13. 40 from 70 leaves how many? *How many are 40 and 30?* —30

SECTION 3.

1. A man received 12 dollars for work, and paid 2 dollars for his board. How many dollars did he save? 10.

2. How many will remain, if we take 2 from 12? 2 from 13? 2 from 14? 2 from 15? 2 from 16? 2 from 17? 2 from 18? 2 from 19? 2 from 20?

3. A stable keeper owned 14 fine horses. After selling off 3 of them, how many had he remaining? 11.

4. How many will remain, if we take 3 from 13? 3 from 14? 3 from 15? 3 from 16? 3 from 17? 3 from 18? 3 from 19? 3 from 20? 3 from 21?

5. 16 boys were dismissed, but 4 of them were called back for being noisy. How many were allowed to go? 12

6. How many will remain, if we take 4 from 14? 4 from 15? 4 from 16? 4 from 17? 4 from 18? 4 from 19? 4 from 20? 4 from 21? 4 from 22?

7. A man, who had 18 dollars, paid 5 dollars for a pair of boots. How many dollars had he remaining? 13

8. How many will remain, if we take 5 from 15? 5 from 16? 5 from 17? 5 from 18? 5 from 19? 5 from 20? 5 from 21? 5 from 22? 5 from 23?

9. If you had just 20 cents, and you should lose 6 cents, how many cents would you then have?

10. How many will remain, if we take 6 from 16? 6 from 17? 6 from 18? 6 from 19? 6 from 20? 6 from 21? 6 from 22? 6 from 23? 6 from 24?

11. A man who had 22 dollars on hand, lent 7 dollars to his neighbour. How many dollars had he remaining? 15

12. How many will remain, if we take 7 from 17? 7 from 18? 7 from 19? 7 from 20? 7 from 21? 7 from 22? 7 from 23? 7 from 24? 7 from 25?

13. 24 peaches grew upon a young peach tree, and the owner took off 8 of them. How many remained on? 15.

14. How many will remain if we take 8 from 18? 8 from 19? 8 from 20? 8 from 21? 8 from 22? 8 from 23? 8 from 24? 8 from 25? 8 from 26?

15. Suppose you had 26 cents, and paid 9 of them for a dozen of quills; how many cents have you left? 17

16. How many will remain, if we take 9 from 19? 9 from 20? 9 from 21? 9 from 22? 9 from 23? 9 from 24? 9 from 25? 9 from 26? 9 from 27? —

17. James received 28 cents, and Charles received 10 cents less than James. How many did Charles receive? 18

18. How many will remain, if we take 10 from 20? 10 from 21? 10 from 22? 10 from 23? 10 from 24? 10 from 25? 10 from 26? 10 from 27? 10 from 28? —

Note to Teachers. The following combinations of numbers may be embraced in quesions by the teacher, thus,—2 *from* 17 *leaves how many?*

2 from 17 15 8 from 19 11 7 from 24 17 5 from 23 18
7 from 21 15 3 from 20 17 9 from 21 12 6 from 24 18
9 from 24 15 9 from 26 17 3 from 18 15 8 from 23 15
3 from 16 13 7 from 18 11 8 from 22 14 3 from 21 18
8 from 26 18 2 from 15 13 6 from 17 11 9 from 27 18
6 from 19 13 6 from 22 16 5 from 18 13 7 from 25 18
5 from 22 17 5 from 19 14 4 from 16 12 2 from 20 18
4 from 20 16 4 from 15 11 2 from 19 17 4 from 22 18
10 from 25 15 10 from 27 17 10 from 26 16 10 from 29 19

SECTION 4.

CORRESPONDENT EXAMPLES.

1. A farmer, who had 19 dollars on hand, received 5 dollars for a sheep. How many dollars had he then? 24

2. A butcher, who had 24 dollars on hand, paid out 5 dollars for a sheep. How many dollars had he left? 19

3. A jeweller gave 17 dollars for a silver watch, and sold it for 6 dollars more than he gave for it. For how many dollars did he sell it? 23

4. A young man gave 23 dollars for a watch, and was obliged to sell it for 6 dollars less than he gave. For how much did he sell it? 17

5. It was 4 years ago, that Samuel left the academy, and he was then 15 years old. How old is he now? 19

6. Sarah is 19 years old; her father died when she was 15. How many years is it, since her father died? 4

7. A farmer who had 26 sheep, purchased 8 more How many sheep had he then?

8. A farmer who had 34 sheep, sold 8 of his flock How many had he remaining?

9. A merchant who had 9 dollars on hand, received 27 dollars more, for a quantity of goods. How many dollars had he then?

10. A merchant who had 36 dollars in his pocket, paid a small debt, and then had 27 dollars left. How many dollars did he pay?

11. A wagon passed along, carrying 38 empty barrels and 7 full ones. How many barrels in all?

12. In a store-room there were 45 barrels, only 7 of which were filled. How many were empty?

13. Edward paid 46 cents for a book, and then had 9 cents left. How many cents had Edward before he purchased the book?

14. Joseph's father gave him 55 cents, to buy a book, but he obtained the book for 46 cents. How many cents did Joseph save?

15. How many are 57 and 5? Then if we take 5 from 62, how many remain?

16. How many are 64 and 6? Then if we take 6 from 70, how many remain?

17. How many are 79 and 8? Then if we take 8 from 87, how many remain?

18. How many are 86 and 6? Then if we take 6 from 92, how many remain?

19. How many are 48 and 9? Then if we take 9 from 57, how many remain?

20. How many are 75 and 7? Then if we take 7 from 82, how many remain?

21. How many are 36 and 5?—how many are 5 and 36? Then 5 from 41 leaves how many?—36 from 41 leaves how many? 36

22. How many are 43 and 9?—how many are 9 and 43? Then 9 from 52 leaves how many?—43 from 52 leaves how many?

23. How many are 54 and 6 ?—how many are 6 and 54? Then 6 from 60 leaves how many?—54 from 60 leaves how many?

24. How many are 68 and 4?—how many are 4 and 68 ? Then 4 from 72 leaves how many?—68 from 72 leaves how many?

25. How many are 79 and 8?—how many are 8 and 79? Then 8 from 87 leaves how many?—79 from 87 leaves how many?

26. How many are 87 and 5?—how many are 5 and 87? Then 5 from 92 leaves how many?—87 from 92 leaves how many?

SECTION 5.

MISCELLANEOUS EXAMPLES.

1. George and David went out to gather lilies; George got 56, and David 49. On the way home, George gave David 8. How many had each boy then? [illegible]

Solution. At first, George had 56; he gave away 8; 8 from 56 leaves 48......At first, David had 49; he received 8 more; 49 and 8 are 57.

2. A clerk went out to collect some money. He received 60 dollars from one man, 9 dollars from another, and 20 from another; and he paid a debt of 7 dollars How many dollars had he to bring in? 82.

Solution. 60 and 9 are 69, and 20 are 89;—this is the number of dollars he collected. He then paid 7 dollars. 7 from 89 leaves 82.

3. Harriet answered 23 questions in arithmetic, and Mary answered 7 more than Harriet. How many questions did they both answer? 53

4. Edward answered 36 questions in arithmetic, and Stephen answered 6 less than Edward. How many questions did they both answer? 66.

5. A blacksmith who had 100 dollars, laid his money out as follows—For iron 66 dollars, for steel 30 dollars, and the remainder for coal. How many dollars did he pay for coal? 10.

6 A carpenter paid 31 dollars for boards, 10 dollars for shingles, 6 dollars for nails, and 5 dollars for screws. How many dollars did he spend? 52.

7. A trader gave 48 dollars for a chest of tea, and 3 dollars for getting it home. For how much must he sell the tea, in order to gain 8 dollars? 59.

8. If I have 70 dollars on hand, and pay out 4 dollars to one man, 20 to another, and 30 to another, how many dollars shall I have remaining? 16.

9. A gentleman travelled 8 miles before breakfast, 30 more before dinner, and 40 more after dinner. How many miles did he travel during the day? 78.

10. A merchant, who had 80 barrels of flour, sold to one man 52 barrels, to another 6 barrels, and to another 5 barrels. How many barrels had he left? 17.

11. Oliver's penknife is worth 33 cents, and Edwin's is worth only 19 cents. Now if they exchange penknives, how many cents must Edwin give Oliver? 14.

12. Arthur's penknife was worth 25 cents, and Walter's was worth only 18 cents: still, A. gave W. 6 cents to exchange. How much did A. lose? 11.

13. On the Fourth of July, Robert had 50 cents given him. He spent 6 cents for fruit, 12 cents for confectionary, 20 cents for a picture of Gen. Washington, and gave away 5 cents. How many cents had he left? 7.

14. Leonard has 32 cents, and Albert has 49. How many cents has Albert more than Leonard? 17.

15. Francis being asked how old he was, answered, that in 14 years more, he should be 25 years old. How old was he, at the time he was asked? 11.

16. If a cow be worth 22 dollars, and a calf 5 dollars, how much more is the cow worth than the calf? 17.

17. A jockey gave 85 dollars for a horse, and sold him for 68 dollars. How much did he lose? 17.

18. A trader gave 83 dollars for a hogshead of sugar, and sold it for 96 dollars. How much did he gain? 13.

19. A farmer gave 24 dollars for a cart, and 12 dollars for a plough. How many dollars did both cost? 36.

20. If a gold watch be worth 64 dollars, and a gold chain 18 dollars, how much are they both worth? 82.

21. A man gave 13 dollars for the improvement of a piece of ground, paid 36 dollars for having it cultivated, and then sold the produce for 48 dollars. How many dollars did he lose? 1,

22. A market-man bought some butter for 8 dollars, some cheese for 15 dollars, and some poultry for 12 dollars; and then sold the whole for 39 dollars. Did he gain or lose?— and how much? 4.

23. John bought a penknife for 25 cents; he exchanged it for a better one, paying 16 cents, and then sold the better one for 40 cents. Did he gain or lose?— and how much? 1

24. A gentleman gave 32 dollars for a piece of cloth, and 13 dollars for having it made into a suit of clothes. How much did the suit cost? 45

25. A tailor gave 54 dollars for some cloth and trimmings; he made the whole into clothes, which he sold for 72 dollars. How much did he gain by the work? 18

26. If a man, having 50 dollars, should buy a barrel of sugar for 24 dollars, and a barrel of molasses for 13 dollars, how many dollars would he have left? 13

27. A scholar gave 55 cents for a geography, and 42 cents for an arithmetic. What did he give for both? 97

28. Ellen had 30 cents; her father gave 16 more, and her mother 10 more; she then bought a book for 45 cents. How many cents had she remaining? 11,

29. James had 38 cents, and his father gave him 14 more—William had 33 cents, and his father gave him 19 more. Which boy then had the most money? 52. 52,

30. Lucy has 75 cents, and she intends buying a book, that will cost 63 cents. How much money has she more than the book will cost? 12

31. A grocer purchased some oranges for 18 dollars, some lemons for 8 dollars, some raisins for 4 dollars, and some figs for 6 dollars; and then sold the whole for 44 dollars. Did he gain or lose?— and how much? 8,

32. A company marched 82 miles in three days. It marched 25 miles the first day, 36 miles the second day, and the remainder of the distance the third day. How many miles did it march the third day? 21.

CHAP. IV.

MULTIPLICATION.

Note to Teachers. In the second and third sections of this chapter, the learners are required to find the products of factors as high as 10 and 20. There are few scholars, who will easily commit these products to memory; and it will, therefore, be necessary to adopt a mental process, by which they may readily be found. The following example will show the process.

Question. How many are 8 times 16? *Solution.* 16 is made up of 10 and 6. Eight times ten are eighty; eight times six are forty-eight. 80 and 48 are 128.

SECTION 1.

1. On the Fourth of July, George and Richard went to the Celebration, and whenever George spent 1 cent, Richard spent 7. In the course of the day, George spent 6 cents. How many did Richard spend? 42.

Solution. Richard must have spent six times seven cents. 6 times 7 are 42.

2. If 4 yards of cloth are required to make 1 cloak, how many yards are required to make 5 cloaks? 20.

3. If 1 boat will carry 5 men across the river, how many men will 3 boats of the same size carry? 15.

4. If a man can earn 8 dollars in one week, how many dollars can he earn in 3 weeks? 24.

5. If a traveller ride 6 miles in one hour, how many miles can he ride in 9 hours? 54.

6. In a garden, there are 5 rows of plum trees; 8 trees in each row. How many trees are there in the garden? 40.

7. In a field there are 8 rows of apple trees; 5 trees in each row. How many trees are there in the field? 40.

8. There were 7 boys, who gave a poor man, 4 cents apiece. How many cents did the man receive? 28.

9. How many merit-marks will Susan get in 6 days, provided she gets 4 every day? 24.

10. How many errors will Jane make in 8 days, provided she makes 3 errors every day? 24.

11. If the price of 1 quart of nuts be 7 cents, for how many cents can you buy 7 quarts? 49.

12. If you should read 9 pages every day, how many pages would you read in 8 days? 72.

13. How many dollars must I pay for 9 yards of cloth, that is worth 6 dollars a yard? 54.

14. How many dollars must I pay for 9 barrels of flour, when the price is 7 dollars a barrel? 63.

15. If 4 bushels of wheat are required for 1 barrel of flour, how many bushels are required for 8 barrels? 32.

16. What is the cost of 7 reams of letter paper, that is sold at 6 dollars per ream? 42.

17. How much will a market-man get for 10 melons, if he sell them at 9 cents apiece? 90

18. If a man can earn 9 dollars in one month, how many dollars can he earn in 6 months? 54.

Section 2.

1. John and Henry together, caught 13 fishes every morning; and it always happened, that John caught 10 of them, and Henry 3. Now how many did each boy catch in 6 mornings?—Then how many did they both catch in 6 mornings? 78.

2. 10 and what number make 13? How many are 6 times 10? 6 times 3? How many are 60 and 18?—Then 6 times 13 are how many? 78.

3. If the diamond in a ring cost 10 dollars, and the ring 4 dollars, what does the diamond-ring cost? 14 What would 5 diamonds cost? 50 What would 5 rings cost?—20 Then what would 5 diamond-rings cost? 70

4. 10 and what number make 14? How many are 5 times 10? 50 5 times 4? 20 How many are 50 and 20?—70 Then 5 times 14 are how many? 70

5. A Northern hunter received a bounty of 10 dollars from the state, and 5 from the county, for killing a wolf: how much did he receive from both? 15 How much would he receive from the state for killing 7 wolves? 70 How much from the county for killing 7?—35 Then how much from state and county both for killing 7? 105

6. 10 and what number make 15? How many are 7 times 10? 70 7 times 5? 35 How many are 70 and 35?—Then 7 times 15 are how many? 105

7. A man hired a horse and gig, to pay 10 cents a mile for the horse, and 6 cents a mile for the gig. How

much a mile did he pay for both ?16 How much for the horse 8 miles ?72 How much for the gig 8 miles ?56 Then how much for the horse and gig, both 8 miles ? 128.

8. 10 and what number make 16 ? How many are 8 times 10 ?80 8 times 6 ?48 How many are 80 and 48 ?—128. Then 8 times 16 are how many ?128.

9. If a man gather 10 barrels of apples, and a boy 7 barrels, in a day, how many barrels do they both gather ? 17. How many barrels can the man gather in 9 days ?90 How many barrels can the boy gather in 9 days ?63 Then how many barrels can they both gather in 9 days ?153.

10. 10 and what number make 17 ? How many are 9 times 10 ?90 9 times 7 ? 63 How many are 90 and 63 ?—153. Then 9 times 17 are how many ? 153.

11. If a man eat 10 ounces of meat in a day, and his wife eat 8 ounces, how many ounces do they both eat in a day ?18 How many ounces will the man eat in 4 days ? 40 How many ounces will the wife eat in 4 days ?32 Then how many ounces will they both eat in 4 days ? 72.

12. 10 and what number make 18 ? How many are 4 times 10 ?40 4 times 8 ?32 How many are 40 and 32 ?—72 Then 4 times 18 are how many ? 72,

13. If a company of soldiers march 10 miles in the forenoon, and 9 miles in the afternoon, how many miles do they march in a day ?19 How many miles would they march in 6 forenoons ?60 How many in six afternoons ?— 54 Then how many miles in 6 days ?114

14. 10 and what number make 19 ? How many are 6 times 10 ?60 6 times 9 ?54 How many are 60 and 54 ?—114 Then 6 times 19 are how many ? 114

15. How many are 6 times 10 ?60 6 times 2 ?12 Then how many are 6 times 12 ? 72

16. How many are 7 times 10 ?70 7 times 3 ?21 Then how many are 7 times 13 ? 91.

17. How many are 8 times 10 ?80 8 times 4 ?32 Then how many are 8 times 14 ? 112

18. How many are 9 times 10 ?90 9 times 5 ?45 Then how many are 9 times 15 ? 135

19. How many are 10 times 10 ?100 10 times 6 ?60 Then how many are 10 times 16 ? 160.

20. How many are 3 times 10? 3 times 7? Then how many are 3 times 17?

21. How many are 2 times 10? 20 2 times 8? Then how many are 2 times 18? 36

22. How many are 5 times 10? 50 5 times 9? Then how many are 5 times 19? 95

23. How many are 4 times 10? 40 4 times 9? Then how many are 4 times 19? 76

SECTION 3.

1. Albert spends 11 cents every month, for stationary. How many cents will he spend in 3 months? 33

2. How many are 2 times 11? 22 3 times 11? 4 times 11? 5 times 11? 55 6 times 11? 66 7 times 11? 8 times 11? 9 times 11? 99 10 times 11? 110

3. If you should write 11 copy-lines every day, how many copy-lines would you write in 10 days? 110

4. If a pound of Malaga raisins cost 12 cents, how many cents will 4 pounds of raisins cost? 48

5. How many are 2 times 12? 24 3 times 12? 36 4 times 12? 5 times 12? 60 6 times 12? 72 7 times 12? 8 times 12? 9 times 12? 10 times 12? 120

6. If you should read 12 verses every morning, how many verses would you read in 9 mornings? 108

7. Suppose a steam boat will go 13 miles in an hour;—how many miles will it go in 5 hours? 65

8. How many are 2 times 13? 3 times 13? 4 times 13? 52 5 times 13? 65 6 times 13? 78 7 times 13? 8 times 13? 104 9 times 13? 10 times 13? 130

9. If a labourer can earn 13 dollars in a month, how many dollars can he earn in 8 months? 104

10. If it take 14 men to navigate one ship, how many men will it take to navigate 6 ships? 84

11. How many are 2 times 14? 3 times 14? 4 times 14? 5 times 14? 70 6 times 14? 7 times 14? 98 8 times 14? 112 9 times 14? 10 times 14? 140

12. If a pound of honey be worth 14 cents, how many cents are 7 pounds of honey worth? 98

13. If a carpenter can make 15 hat boxes in a day, how many hat boxes can he make in 2 days? 30

14. How many are 2 times 15? 30 3 times 15? 45 4 times 15? 60 5 times 15? 75 6 times 15? 90 7 times 15? 105 8 times 15? 120 9 times 15? 135 10 times 15? 150

15. If a shoemaker make 15 pairs of shoes in a week, how many pairs will he make in 10 weeks? 150

16. How much would a man earn in 3 months, provided his wages were 16 dollars a month? 48

17. How many are 2 times 16? 32 3 times 16? 48 4 times 16? 64 5 times 16? 80 6 times 16? 96 7 times 16? 112 8 times 16? 128 9 times 16? 144 10 times 16? 160

18. How much would a man spend in 9 months, if his expenses were 16 dollars a month? 144

19. If 17 barrels of flour can be carried on one wagon, how many barrels may be carried on 4 wagons? 68

20. How many are 2 times 17? 34 3 times 17? 51 4 times 17? 68 5 times 17? 85 6 times 17? 102 7 times 17? 119 8 times 17? 136 9 times 17? 153 10 times 17? 170

21. If one hogshead of molasses be worth 17 dollars, what is the value of 8 hogsheads of molasses? 136

22. If 5 men should pay me 18 dollars apiece, how many dollars should I receive from them all? 90

23. How many are 2 times 18? 36 3 times 18? 54 4 times 18? 72 5 times 18? 90 6 times 18? 108 7 times 18? 126 8 times 18? 144 9 times 18? 162 10 times 18? 180

24. If I should pay to 7 men, 18 dollars apiece, how many dollars should I pay to all of them? 126

25. How much would a farmer get for 3 cows, if he should sell them for 19 dollars apiece? 57

26. How many are 2 times 19? 38 3 times 19? 57 4 times 19. 76 5 times 19? 95 6 times 19? 114 7 times 19? 133 8 times 19? 152 9 times 19? 171 10 times 19? 190

27. If you answer 19 questions at every recitation, how many would you answer in reciting 6 times? 114

28. Paper is generally packed in reams, of 20 quires each. How many quires are there in 4 reams? 80

29. How many are 2 times 20? 40 3 times 20? 60 4 times 20? 80 5 times 20? 100 6 times 20? 120 7 times 20? 140 8 times 20? 160 9 times 20? 180 10 times 20? 200

30. If a trader make 20 cents on every pound of tea he sells, how much will he make on 5 pounds. 100

SECTION 4.

1 An ounce is a small weight, 16 of which make a pound. How many ounces of tea are there in 3 pounds and 9 ounces of tea? 57

Solution. In 1 pound there are 16 ounces, and in 3 pounds there are 3 times 16 ounces. 48 3 times 16 ounces are 48 ounces. 48 ounces and 9 ounces are 57 ounces.

2. How many ounces in 8 pounds and 4 ounces? 132

3. 20 penny-weights of gold make 1 ounce. How many penny-weights in 4 ounces and 13 penny-weights? 93

4. How many penny-weights are there in 6 ounces and 9 penny-weights? 129

5. The brewer sells his beer by the firkin, and a firkin holds as much as 9 gallon measures. How many gallons are there in 10 firkins and 6 gallons? [illegible]

6. In 7 firkins and 3 gallons, how many gallons? 66

7. 40 rods, measured by a surveyor's chain, make 1 furlong. How many rods in 3 furlongs and 17 rods? 137

8. In 4 furlongs and 8 rods, how many rods? 168

9. There are 12 months in a year. How many months are there in 6 years and 6 months? 78

10. In 9 years and 10 months, how many months? 118

11. 4 pecks of oats, peas, beans, or any other dry commodity, make 1 bushel. How many pecks of wheat are there in 6 bushels and 3 pecks? 27

12. In 10 bushels and 1 peck, how many pecks? 41

13. 12 pence, in English money, make 1 shilling. How many pence are there in 8 shillings and 6 pence? 102

14. In 10 shillings and 9 pence, how many pence? 129

15. 10 cents, in Federal money, make 1 dime. How many cents are there in 7 dimes and 6 cents? 76

16. In 4 dimes and 8 cents, how many cents? 48

17. In 1 month there are 30 days. How many days are there in 3 months and 15 days? 105

TABLE OF FACTORS AND PRODUCTS

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60
4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80
5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120
7	14	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160
9	18	27	36	45	54	63	72	81	90	99	108	117	126	135	144	153	162	171	180
10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200

When two or more numbers are multiplied together, they are called *Factors;* and the number arising from them is called their *Product.* For example, 3 and 4 are factors, 12 being their product. In this table, the numbers in the top line, and those in the left hand column, stand as factors. The product of any two factors appears in the table, directly under one factor in the top line, and off against the factor in the left column.

CHAP. V.

DIVISION.

Section 1.

1. A lady divided 15 peaches among some little girls, giving 3 to each girl. How many girls were there? 5

Solution. As many times as 3 peaches are contained in 15 peaches, so many girls there were.

2. If you had 16 cents to lay out in pencils, and the price of the pencils were 4 cents apiece, how many could you buy for all the money? 4

3. How many times is 4 contained in 16? 4

4. If 4 horses are required to draw one wagon, how many wagons might be drawn by 20 horses? 5

5. How many times 4 in 20? 5 *How many are 5 times 4?*

6. If a man can travel 4 miles in one hour, how many hours will it take him to travel 12 miles? 3

7. How many times 4 in 12? 3 *How many are 3 times 4?*

8. How many yards of broadcloth, that is sold at 7 dollars a yard, can be purchased for 14 dollars? 2

9. How many times 7 in 14? 2 *How many are 2 times 7?*

10. How many lead pencils could you buy for 18 cents, if they were sold at 6 cents apiece? 3

11. How many times 6 in 18? 3 *How many are 3 times 6?*

12. In an orchard there are 35 trees, standing in rows, 7 trees in a row. How many rows are there? 5

13. How many times 7 in 35? 5 *How many are 5 times 7?*

14. A man bought sheep at 4 dollars apiece, and paid for them all, 24 dollars. How many did he buy? 6

15. How many times 4 in 24? 6 *How many are 6 times 4?*

16. A gardener set out 30 peach trees, in rows, putting 5 trees in a row. How many rows were there? 6

17. How many times 5 in 30? 6 *How many are 6 times 5?*

18. A farmer got 36 dollars for some sheep, that he sold at 6 dollars apiece. How many were there? 6

19. How many times 6 in 36? 6 *How many are 6 times 6?*

20. A trader wishes to pack 56 hats in boxes, putting 8 hats in a box:—how many boxes are wanted? 7.

21. How many times 8 in 56? 7 *How many are 7 times 8?* 56.

22. How many dozen of eggs can you buy for 63 cents, when they are sold at 9 cents a dozen? 7.

23. How many times 9 in 63? 7 *How many are 7 times 9?* 63.

24. If an orange be worth 6 cents, and a lime 1 cent, then how many oranges are 60 limes worth? 10

25. How many times 6 in 60? 10 *How many are 10 times 6?* 60.

26. If one silk bonnet be worth 7 handkerchiefs, how many bonnets are 56 handkerchiefs worth? 8

27. How many times 7 in 56? 8 *How many are 8 times 7?* 56.

28. If I give a barrel of flour for 4 bushels of wheat, how many barrels must I give for 36 bushels? 9.

29. How many times 4 in 36? 9 *How many are 9 times 4?* 36.

30. If a man can build 8 rods of fence in a day, how many days will it take him to build 72 rods? 9.

31. How many times 8 in 72? 9 *How many are 9 times 8?* 72.

32. If 5 bushels of wheat will pay for a yard of broad cloth, how many yards will 45 bushels pay for? 9

33. How many times 5 in 45? 9 *How many are 9 times 5?* 45.

34. Lafayette was 42 days on his passage from Toulon to New York. How many weeks was his passage? 6.

35. How many times 7 in 42? 6. *How many are 6 times 7?* 42.

SECTION 2.

1. Suppose 2 men have 8 biscuit to divide equally between them;—how many must each man take? 4.

Observation. There are 2 men to share the biscuit, and if there were only 2 biscuit to be divided, then 1 man would take 1 biscuit. Therefore, 1 man will now take 1 biscuit of every 2 biscuit.

Solution. As many times as 2 is contained in 8, so many biscuit must each man take. 2 is contained in 8, 4 times.

2. If 12 dollars be divided equally between 2 men, how many dollars does each man receive? 6

3. If 18 chestnuts should be divided equally between 2 boys, how many would each boy receive? 9

4. A tenant cultivated a piece of corn, agreeing to give the owner of the land 1 bushel of every 2 bushels that he might raise. He raised 22 bushels. How many bushels should the owner of the land receive?

5. Suppose 3 boys have 12 oranges to divide equally between them;—how many must each boy take? 4

Observation. If the 3 boys had only 3 oranges to divide, each boy would take 1 orange;—if they had 2 times 3 oranges, each boy would take 2 times 1 orange:—and thus, each boy will take as many times 1 orange, as there are *threes* in the number to be divided.

Solution. As many times as 3 is contained in 12, so many oranges must each boy take. 3 in 12, 4 times.

6. If 15 biscuit be divided equally between 3 men, how many biscuit does 1 man receive? 5

7. 3 careless boys must pay 24 cents for breaking a square of glass. What must each boy pay? 8

8. A man set out 27 trees, in 3 rows; an equal number in each row. How many were there in one row? 9

9. 4 boys have 12 oranges to divide equally between them. How many will each boy receive? 3

Observation. If the 4 boys had only 4 oranges to divide, then each boy would receive 1 orange. Therefore each boy must receive 1 orange of every 4 oranges that there are in the number to be divided.

Solution. As many times as 4 is contained in 12, so many oranges will each boy receive. 4 in 12, 3 times.

10. I have 32 minutes to spend on 4 lessons. How many minutes can I spend on each lesson? 8

11. Suppose I wish to give 28 quills to 4 boys;—how many must I give to each boy? 7

12. 4 men received 20 dollars for doing a piece of work. How much was each man's share? 5

13. A fisherman hired a boat, agreeing to give the owner, 1 fish of every 5, that he might catch: he caught 20. How many should he give the owner? 4

14. If 35 pounds of beef be divided among 5 soldiers, how many pounds does each soldier receive? 7

15. 5 men have agreed to pay equal shares of 50 dollars. How many dollars must one man pay? 10

16. Charles was one of 6 boys, who owned together 42 books. They divided the books, and Charles received 1 book of every 6 books. How many did he receive.

17. If 24 books should be divided equally among 6 boys, how many would each boy receive?

18. 6 men have agreed to pay 36 dollars in equal shares. How many dollars must each man pay? 6

19. Edward is one of 7 boys, who are to have 28 peaches divided equally among them. How many will Edward receive for his share? 4

20. If 7 writing-books be made of 42 sheets of paper, how many sheets are there in each book?

21. 8 boys owned together 72 quills; and, in order to share them equally, each boy took 1 quill from every 8 quills in the number. How many did each boy take?

22. I have 48 dollars to divide among 8 men. How many dollars must I give to one man? 6.

23. 9 men shared 45 bushels of corn among them, each man taking for his share, 1 bushel of every 9 bushels. How many bushels did each man take? 5

24. 9 persons have agreed to make up a purse of 72 dollars. How many dollars must each one put in? 6

25. 10 sailors are to receive 90 dollars for retaking their ship. How much will each sailor receive? 9.

SECTION 3.

1. Charles has 25 cents, which he has engaged to appropriate as follows. Whenever he blots his writing-book, he is to lay it aside, and pay 6 cents for a new one. Now how many books can he pay for; and how many cents will he have remaining, after his number becomes too small to buy another book. 4. 1.

Observation. If his whole number of cents were 30, he could then pay for five books; because, 6 cents are contained in 30 cents, 5 times. Again, if his whole number of cents were only 24, he could then pay for 4 books; because, 6 cents are contained in 24 cents, 4 times.

2. Suppose it takes 8 buttons to trim a vest:—how many vests can the tailor, who has only 34 buttons, trim, and what number of buttons will he have remaining? 4. 2.

3. How many times 8 in 34; and how many over?

4. How many glass tumblers, at 10 cents apiece, can a woman that has only 53 cents, buy; and how many cents will she have remaining?

Solution. As many times as 10 is contained in 53, so many tumblers she can buy. 10 is contained in 53, 5 times, and there is three over.

5. How many kegs, that will hold 7 gallons apiece, may be filled from a cask of wine containing 46 gallons, and how many gallons will remain in the cask?

6. How many times 7 in 46; and how many over?

7. A hat-maker has 53 hats finished; and, in order to send them to market, he must pack them in boxes, that will hold 8 hats apiece. How many full boxes can he send; and how many hats will remain on hand?

8. How many times 8 in 53; and how many over?

9. A trader has 69 dollars with which he wishes to purchase hats. If he should pay 7 dollars apiece for the hats, how many could he purchase; and how many dollars would he have remaining?

10. How many times 7 in 69; and how many over?

11. If 4 yards of cloth will make 1 cloak, how many cloaks can be made from a piece of cloth containing 38 yards; and how many yards will there be over?

12. How many times 4 in 38; and how many over?

13. How many times is 4 contained in 29; and how many over? *How many are 7 times 4, and 1 more?*

14. How many times is 6 contained in 53; and how many over? *How many are 8 times 6, and 5 more?*

15. How many times is 9 contained in 57; and how many over? *How many are 6 times 9, and 3 more?*

16. How many times is 7 contained in 68; and how many over? *How many are 9 times 7, and 5 more?*

17. How many times is 5 contained in 49; and how many over? *How many are 9 times 5, and 4 more?*

18. How many times is 3 contained in 26; and how many over? *How many are 8 times 3, and 2 more?*

19. In 15, how many times 4; and how many over? In 17? In 26? In 33? In 27? In 42?

20. In 27, how many times 5; and how many over? In 29? In 36? In 32? In 44? In 48?

21. In 28, how many times 6; and how many over? In 37? In 38? In 46? In 49? In 22?

22. In 30, how many times 7; and how many over? In 36? In 43? In 48? In 51? In 59?

23. In 28, how many times 8; and how many over? In 35? In 46? In 52? In 61? In 75?

24. In 31, how many times 9; and how many over? In 34? In 42? In 50? In 67? In 70?

25. A gallon measure, used for measuring wine, beer, milk, &c. will contain as much as 4 quart measures Suppose I have 15 quart measures full of water;—how many gallon measures can I fill from them; and how many quarts will there be over? 3. 3.

26. How many gallons are there in 34 quarts? 8, 2.

27. 3 feet, measured on a line, are the same as 1 yard. How many yards are there in 29 feet? 9. 2.

28. How many yards are there in 17 feet? 5, 2 7.

29. 60 minutes, by the clock, make 1 hour. How many hours are there in 128 minutes? 2. 8.

30. 12 inches, on the carpenter's rule, make 1 foot. How many feet long is a board, that is 65 inches long? 5. 5.

31. How many feet are there in 38 inches? 3, 2.

32. 8 drams of medicine, weighed by the apothecary, are the same as 1 ounce of medicine. How many ounces are there in 46 drams? 5, 6.

33. How many ounces are there in 30 drams? 3, 6.

34. 9 square feet, measured upon the floor, make 1 square yard. How many square feet are there in 20 square yards? 2, 2.

35. How many square yards in 51 square feet? 5. 6.

36. 7 days are 1 week. How many weeks in 33 days? 4, 5.

37. How many weeks are there in 52 days? 7. 3.

38. 12 pence, in English money, make 1 shilling. How many shillings are there in 69 pence? 5, 9.

39. How many shillings are there in 46 pence?

40. 10 cents, in Federal money, make 1 dime. How many dimes are there in 48 cents? 4, 8

1. How many dimes are there in 95 cents? 9, 5

SECTION 4.

CORRESPONDENT EXAMPLES.

1. How much will 5 pounds of dates cost, when the price of them is 7 cents a pound? 35

Solution. If one pound cost 7 cents, 5 pounds will cost 5 times 7 cents. 5 times 7 are 35.

2. How many pounds of dates can you buy for 35 cents, the price being 7 cents a pound? 5

Solution. I can buy as many pounds of dates as 7 is contained times in 35. 7 in 35, 5 times.

3. How many quarts of wine are there in 10 gallons; there being 4 quarts in one gallon? 40

4. How many gallons of wine are there in 40 quarts; every 4 quarts making one gallon? 10

5. How many pence are there in 5 shillings; there being 12 pence in 1 shilling? 60

6. How many shillings are there in 60 pence; there being 12 pence in 1 shilling? 5

7. In 1 penny there are 4 farthings. How many farthings in 9 pence and 3 farthings? 39

8. How many pence are there in 39 farthings,—and how many farthings are there over? 9. 3

9. A gentleman went on a journey of 9 days, and paid for his expenses, 4 dollars per day. How much were his expenses during the whole journey? 36.

10. A gentleman, who had been away on a journey for 9 days, found on his return, that he had spent 36 dollars. How much did he spend a day? 4

Suggestion. 9 dollars would allow him 1 dollar a day.

11. If 6 bushels of onions grow upon 1 square rod of ground, how many bushels will grow upon 10 rods? 60

12. A man raised 60 bushels of onions upon 10 rods of ground. How many bushels grew upon 1 rod? 6.

13. If a ship sail 7 miles an hour, how many miles will she sail in 7 hours? 49.

14. If a ship sail 49 miles in 7 hours, how many miles does she sail in 1 hour? 7.

SECTION 5.

CONNECTED OPERATIONS

1. A market man sold 10 pounds of cheese at 8 cents a pound, and received his pay in sugar at 10 cents a pound. How many pounds of sugar did he receive? 8,

Solution. The price of 1 pound of cheese being 8 cents, the price of 10 pounds is 10 times 8 cents, or 80 cents.——80 cents will pay for as many pounds of sugar, as there are times 10 in 80. 10 in 80, 8 times.

2. In 10 times 8, how many times 10? 8,

Solution. 10 times 8 are 80.——10 in 80, 8 times.

3. 4 coaches went from Baltimore to Washington, each carrying 6 boys: the same boys returned, riding 8 in a coach. In how many coaches did they return? 3,

4. In 4 times 6, how many times 8? 3.

5. How many boxes of raisins at 6 dollars a box, will pay for 4 kegs of tobacco at 9 dollars a keg? 6.

6. In 4 times 9, how many times 6? 6,

7. How many sheep worth 4 dollars a head, must be given for 6 tons of hay, worth 8 dollars a ton? 12,

8. In 6 times 8, how many times 4? 12,

9. How many reams of paper at 3 dollars a ream, will pay for 5 dozen of books at 6 dollars a dozen? 10,

10. In 5 times 6, how many times 3? 10.

11. A hunter, in Michigan, sold 7 pelts at 5 dollars a pelt, agreeing to take his pay in muskets at 8 dollars apiece. The purchaser counted out as many muskets as the pelts would pay for, and finding there was still a balance due to the hunter, he paid this in money. How many muskets and how much money did the hunter receive? 4. 3

12. In 7 times 5 how many times 8; how many over? 4. 3.

13. In 3 times 4 how many times 5; how many over? 2, 2,

14. In 8 times 5 how many times 7; how many over? 5. 5.

15. In 7 times 7 how many times 5; how many over? 9, 4.

16. In 5 times 6 how many times 4; how many over? 7, 2.

17. In 9 times 3 how many times 6; how many over? 4, 3

18. In 4 times 8 how many times 9; how many over? 3. 5.

19 In 6 times 9 how many times 8; how many over? 6, 6.

35-

Note to Teachers. In performing oral solutions which involve several operations, it will be found convenient, although not absolutely necessary, to use the terms *plus* and *minus*. These terms, however, should not be adopted until they are perfectly understood; and the duty of explaining them is here confided to the Teacher. It will not suffice, merely to tell the learner, that "*plus* means *more*, and *minus* means *less*," for the idiom of our language does not allow him to use *more* and *less*, as he is called upon to use *plus* and *minus*. The expressions, "7 more 5 is 12," and, "10 less 4 is 6," although true, are not very likely to meet the understanding of a young scholar. Perhaps it will be found necessary to resort to illustrations like the following.

Place 8 books in a pile before you, and say,—"Here is a pile of 8 books, and I shall make the number of books in the pile 3 more." Then, placing 3 additional books upon the pile, say,—"8 books plus 3 books are 11 books." Again proceed to say,—"I shall now make the number 2 less." Then, taking off 2 books, say,—"11 books, minus 2 books are 9 books."

SECTION 6.

MISCELLANEOUS EXAMPLES.

1. How many days in the three Summer months;—there being 30 in June, 31 in July, and 31 in August?

Solution. 30 days plus 31 days are 61 days; 61 days plus 31 days are 92 days.

2. There were 42 gallons of wine in a cask; but, the cask not being tight, 7 gallons have leaked out. How many gallons still remain in the cask? 35-

Solution. 42 minus 7 is 35. *Answer.* 35 gallons.

3. A boy that had 97 cents, paid 62 cents for a book, 18 cents for a morocco wallet, and 6 cents for a pencil. How many cents had he remaining? 11

Solution. 62 cents (for book), plus 18 cents (for wallet), is 80 cents; 80 cents plus 6 cents (for pencil), is 86 cents. 97 cents minus 86 cents is 11 cents.

4. A black-smith bought 9 tons of coal, at 4 dollars per ton, and gave 3 dollars for having it drawn to his shop. How much did the coal cost him?

Solution. If the price of 1 ton was 4 dollars, the price of 9 tons was 9 times 4 dollars, or 36 dollars; 36 dollars plus 3 dollars (for having it drawn) is 39 dollars.

5. A schoolmaster laid out 96 cents in writing-books, at 8 cents apiece, and then gave away 5 of them. How many books had he remaining? 7

Solution. He bought as many books, as 8 is contained times in 96, which is 12. Then, 12 books minus 5 books, (that he gave away), are 7 books.

6. A trader gave 16 dollars for a keg of tobacco, and after selling it, found he had gained 6 dollars. For how much did he sell it?

7. A rich farmer in Vermont had a flock of 100 sheep; they went upon a mountain, and the wolves destroyed 16 of them. How many sheep had he remaining?

8. If a man spend 4 dollars in a week, how many dollars will he spend in 9 weeks?

9. How many dozen of eggs can you buy for 64 cents, when the price of them is 8 cents per dozen?

10. A trader gave 48 dollars for 7 barrels of flour, and sold it for 6 dollars a barrel. What did he lose? 6

11. How many weeks are there in 35 days? 5

12. Four men made up a purse of 40 dollars, for a charitable purpose. The first man put in 9 dollars, the second 12 dollars, and the third 7 dollars;—how much did the fourth man put in? 12

13. A sum of money was divided equally among 8 sailors; and Jack, who was one of the number, received for his share, 15 dollars. What was the sum divided? 120

14. How many days are there in 13 weeks and 5 days?

15. A trader bought 3 reams of paper, at 5 dollars per ream, and 7 maps, at 5 dollars apiece. How much did he give for the whole?

16. If 49 bushels of corn should be divided equally among 7 men, how much would one man receive? 7

Solution. As many times as 7 is contained in 49, so many bushels would one man receive.

17. If 45 dollars be divided equally between 5 men, how many dollars does each man receive?

18. A man bought a turkey weighing 10 pounds, for 8 cents a pound, and then sold it for 3 cents a pound more than he gave. For how much did he sell it? 11

19. Charles had 25 cents; his father gave him 4 melons, which he sold for 6 cents apiece; he then paid 12 cents for a book. How many cents had he left? 37

20. If a man earn 6 dollars a week, how many weeks will it take him to earn 48 dollars? 8

21. Geographers consider the United States in four classes. There are 6 Eastern states, 4 Middle states,

8 Southern states, and 6 Western states. How many states are there in the Union? 24

22. A merchant paid 43 dollars for some iron, and sold it for 35 dollars. How many dollars did he lose? 8.

23. A man paid 78 dollars for a piece of land, and 16 dollars for having it fenced; and he then sold it for 100 dollars. Did he gain or lose;—and how much? 6.

24. A cabinet-maker sold 6 tables, at 14 dollars apiece. How many dollars did he receive? 84.

25. If I buy 10 yards of cloth, at 7 dollars a yard, how many five-dollar bills must I pay for it? 14

26. How many boxes of strawberries can you buy for 36 cents, when they are sold at 9 cents a box? 4

27. Suppose a trader, who has 12 barrels of flour on hand, should lay out 35 dollars in buying more flour, at 5 dollars a barrel; how many barrels would he have? 19.

28. If I pay 19 dollars to one man, 13 to another, and 31 to another, how many dollars do I pay out? 63.

29. If a laborer can earn 7 dollars in a week, how many weeks will he be in earning 42 dollars? 6.

30. How many hats, that are sold at 6 dollars apiece, can a man who has 50 dollars pay for;—and how many dollars will he have remaining? 8, 2.

31. If you should perform 19 examples in arithmetic, every day, how many would you perform in 6 days? 114.

32. Samuel Moderate earns 7 dollars a month, and John Smart earns 15 dollars a month. How much more will John earn than Samuel, in 6 months? 48.

33. If 1 man do 1 day's work in 1 day, how many men will it take to perform 7 days' work, in 1 day? 7.

34. If 4 men will perform 4 days' work in 1 day, how many days' work will 4 men perform in 9 days? 36.

35. How many days will it take 4 men to dig a cellar, that 1 man would be 36 days in digging? 9.

36. How many days will it take 7 men to clear a piece of wood-land, that 28 men can clear in one day? 4.

37. How many men will it take to perform as much work in 1 day, as 11 men can perform in 6 days? 66

38. How many days will it take 4 men to perform the same work, that 12 men can perform in 3 days? [illegible]

39 A trader has three bundles of bank notes;—23 dollars in one bundle, 15 dollars in another, and 34 dollars in another; but in one of the bundles there is a note of 5 dollars, which is counterfeit. How many dollars of good money has he?

40. Stephen has lost 30 cents, and has found 10 cents; he now has 18 cents. How much had he at first?

41. A farmer went to the city with 8 barrels of cider, which he sold at 4 dollars a barrel. He then purchased 8 hogsheads of salt, at 3 dollars per hogshead, and paid an old debt of 12 dollars. How many dollars had he to carry home?

42. If I pay 3 dollars apiece for 7 umbrellas, and 6 dollars apiece for 6 hats, for how many dollars must I sell the whole, in order to gain 7 dollars?

43. A man borrowed 75 dollars, and the next day paid all but 14 dollars of it. How much did he pay?

44. A. spent 5 dollars as often as B. spent 3 dollars. How much did A. spend, while B. spent 27 dollars?

Solution. As many times as 3 dollars are contained in 27 dollars, so many times 5 dollars did A. spend. 3 dollars are contained in 27 dollars 9 times; therefore A. spent 9 times 5 dollars.

45. A man and a boy were gathering corn;—the man gathered 7 rows, in the same time that the boy gathered 4 rows. How many rows would the man gather, while the boy was gathering 32 rows?

46. A man and a boy were digging potatoes;—the man dug 11 bushels in the same time that the boy dug 6 bushels. How many bushels would the boy dig, while the man was digging 55 bushels?

47. Suppose butter to be worth 12 cents a pound, and tea 42 cents a pound;—how many pounds of butter must be given for 2 pounds of tea?

48. A farmer sold 2 cows at 23 dollars apiece, and 9 sheep at 5 dollars apiece; he received in payment, 3 ploughs at 8 dollars apiece, and the rest in money. How much money did he receive?

49. 4 boys found a purse containing 29 dollars. They paid 2 dollars for advertising it; and, as no owner ap-

peared, they agreed to take 6 dollars apiece to themselves, and give the remainder to a poor woman. How much was there remaining for the woman ? 18.

50. What sum of money must be divided among 16 men, in order that one man shall receive 4 dollars ? 64.

51. Two classes are studying arithmetic. The first class is 81 examples in advance of the second; the second performs 40 examples in a day, and the first, 31. In how many days will the second overtake the first ? 9.

52. A lady paid 6 dollars for silk, 9 dollars for cambric, 7 dollars for linen, and then had 13 dollars remaining. How many dollars had she at first ? 35.

53. How many barrels of flour, at 6 dollars per barrel, can the baker who has 45 dollars, purchase; and how many dollars will he have remaining ? 7. 3.

54. A trader, that has 48 dollars, wishes to buy all the boots he can pay for, at 5 dollars a pair, and then lay out the remainder of his money in shoes, at 1 dollar a pair. How many pairs of boots, and of shoes, must he buy ?

55. What sum of money must be divided among 18 men, in order that one man shall receive 7 dollars ? 6. 3,

56. Three men made up a purse of 40 dollars. The first man put in 6 dollars, and the second 3 times as much as the first. How much did the third put in ? 16.

57. Eliza gave a poor woman 4 cents, Augusta gave her 3 times as much as Eliza, and Lucy 3 times as much as Augusta. How much did the woman receive ? 52,

58. If a man dig 30 bushels of potatoes in a day, and a boy 13 bushels, how many bushels will they both dig in a day ? 43 How many will they both dig in 3 days ? 129.

59. A farmer purchased 15 sheep;—he sold 8 of them at 4 dollars apiece, and the remainder at 3 dollars apiece; and then found that he had gained 7 dollars. How much did he give for the sheep ? 45,

CHAP. VI.

FRACTIONS.

Section 1.

Note to Teachers. The subsequent progress of the learner, will depend much on a proper conception of the division of unity, and a correct application of the nomenclature of fractions. Therefore, this section, however simple it may appear, should not be slighted. It should be recited with the books closed.

The picture of a board.

This board, as it is presented above, is a *whole* thing. The same board appears hereafter divided into *parts*; and the parts are named according to their number and size.

Divided now into 2 equal parts.
One of these parts is one-*half.*

1. How many halves are there in the whole of any thing?

2. Suppose I can write a letter on 1-half of a sheet of paper; how much paper shall I use, in writing 2 letters?

3. How much is 1-half and 1-half, added together?

Divided now into 3 equal parts.
One of these parts is one-*third.*

4. How many thirds are there in the whole of any thing?

5. If a carpenter can make 3 door-panels of 1 board, what part of one board will he use, in making 1 panel?

6. Which is the greater part, 1-half, or 1-third?

Divided now into 4 equal parts.
One of these parts is one-*fourth.*

7. How many fourths are there in the whole of 1 thing?

8. I gave 1-fourth of an orange to John, and 2-fourths to Frances. How much of the orange did I give away?

9. Which is the greater part, 1-third, or 1-fourth?

Divided now into 5 equal parts.
One of these parts is one-*fifth.*

10. How many fifths are there in the whole of any thing?

11. Charles divided a melon, equally among 5 boys. What part of the melon, [how many fifths,] had 2 boys?

12 Which is the smaller part, 1-fourth, or 1-fifth?

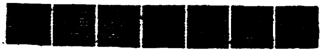
Divided now into 6 equal parts.
One of these parts is one-*sixth.*

13. How many sixths are there in the whole of any thing?

14. If 3 girls and 2 boys should each of them eat 1-sixth of a pie, what part of the whole pie would they all eat?

15. Which is the greater part, 1-fifth, or 1-sixth?

Divided now into 7 equal parts.
One of these parts is one-*seventh.*

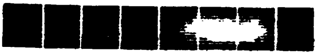


16. How many sevenths are there in the whole of 1 thing?

17. John broke off 2-sevenths of a new pencil, and cut off 1-seventh more. How much of it was then wasted?

18. Which is the smaller part, 1-sixth, or 1-seventh?

Divided now into 8 equal parts.
One of these parts is one-*eighth.*

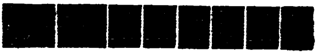


19. How many eighths are there in the whole of 1 thing?

20. If a boy earn 3 eighths of one dollar, and find 4-eighths more, what part of one dollar will he then have?

21 Which is the smaller, 1-seventh, or 1-eighth?

Divided now into 9 equal parts.
One of these parts is one-*ninth.*

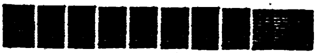


22. How many ninths are there in the whole of 1 thing?

23. Stephen paid 3-ninths of all his money for a slate, and 6-ninths for a blank-book. How much had he left?

24. Which is the greater part, 1-eighth, or 1-ninth?

Divided now into 10 equal parts.
One of these parts is one-*tenth.*



25. How many tenths are there in the whole of 1 thing?

26. If a book cost 5-tenths of a dollar, and a penknife cost 4-tenths, what part of 1 dollar will they both cost?

27. Which is the greater part, 1-ninth, or 1-tenth?

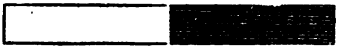
Remark 1st. It appears from the examples above, that, ONE-HALF of any thing, is one of two equal parts of the thing;—ONE-THIRD of any thing, is one of three equal parts of the thing;—ONE-FOURTH of any thing, is one of four equal parts of the thing; and so on.

Remark 2nd. The greater the number of parts is, into which any thing is divided, the smaller the parts are.

SECTION 2

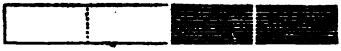
Note to Teachers. One object in this section is, to lead the pupil to apply correctly the terms expressing fractional parts. Every answer, therefore, must be given in a vulgar fraction, *unreduced.* For example, *two fourths* is the answer which must be given to the 3d question. The books to be closed during the recitation of this section.

1. If we divide any thing into 2 equal parts, and take away 1 of the parts, how much of the thing is left?



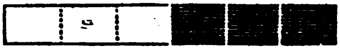
2. If we divide any thing into 3 equal parts, and take away 2 of the parts, how much of the thing is left?

3. If we divide any thing into 4 equal parts, and take away 2 of the parts, how much of the thing is left?

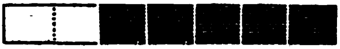


4. If we divide any thing into 5 equal parts, and take away 3 of the parts, how much of the thing is left?

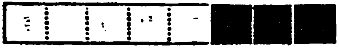
5. If we divide any thing into 6 equal parts, and take away 3 of the parts, how much of the thing is left?



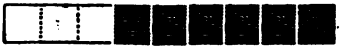
6. If we divide any thing into 7 equal parts, and take away 2 of the parts, how much of the thing is left?



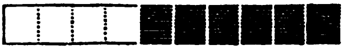
7. If we divide any thing into 8 equal parts, and take away 5 of the parts, how much of the thing is left?



8. If we divide any thing into 9 equal parts, and take away 3 of the parts, how much of the thing is left?



9. If we divide any thing into 10 equal parts, and take away 4 of the parts, how much of the thing is left?



10. Into how many parts must any thing be divided, so that 1 part shall be 1-eleventh?—Into how many, so that 1 part shall be 1-twelfth?—1-thirteenth?

SECTION 3.

Note to Teachers. The learners may be referred to *Remark 1st.* under the first section of examples in this chapter, for a correct form of expression to be adopted in answering the 1st., 4th., 7th., and other similar questions in this section. Books to be closed during the recitation of this section.

1. What is meant by *one-half* of any thing?

2. Suppose you have 1-half of 1 dollar;—what part of a dollar more must you get, to make up 1 dollar?

3. How many halves are equal to a whole one?

4. What is meant by *one-third* of any thing?

5. If I should cut 1 orange into thirds, and give you 2-thirds of it, what part of an orange would you still want, to make up 1 orange by joining the parts together?

6. How many thirds are equal to a whole one?

7. What is meant by *one-fourth* of any thing?

8. Suppose you have 1-fourth of 1 dollar,—what part of a dollar must you get, to make up 1 dollar?

9. How many fourths are equal to a whole one?

10. What is meant by *one-fifth* of any thing?

11. If I should cut 1 apple into fifths, and give you 4-fifths of it, what part of an apple would you still want, to make up 1 apple by joining the parts together?

12. How many fifths are equal to a whole one?

13. What is meant by *one-sixth* of any thing?

14. If I own 2-sixths of 1 acre of land, and I wish to own 1 acre, what part of 1 acre must I buy?

15. How many sixths are equal to a whole one?

16 What is meant by *one-seventh* of any thing?

17. A man bought 4-sevenths of a pound of tea at one shop, and enough more at another shop to make 1 pound. What part of 1 pound did he buy at the last shop?

18. How many sevenths are equal to a whole one?

19. What is meant by *one-eighth* of any thing?

20. James had 5-eighths of a dollar given him, and he earned 3-eighths more. How much money had he then?

21. How many eighths are equal to a whole one?

22 What is meant by *one-ninth* of any thing?

23. If I have 7-ninths of 1 acre of land, and I wish to own 1 acre, what part of 1 acre must I buy?

24. How many ninths are equal to a whole one?

25. What is meant by *one-tenth* of any thing?

26. Suppose you have 8-tenths of 1 dollar,—what part of a dollar must you get, to make up 1 dollar?

27. How many tenths are equal to a whole one?

RELATIONS OF NUMBERS.

Section 4.

Note to Teachers. The object of this section is, to show the correspondence of the division of a unit, with the division of a collection of units. The questions that inquire, *what part* of one number is another number, must be answered in the terms of vulgar fractions. For instance,—the answers required in the 9th example are,—1 is 1-fourth of 4; 2 is 2-fourths of 4; 3 is 3-fourths of 4.

A collection of units is now to be viewed as a single thing; therefore the verb singular will be used thus—3 times 4 *is* 12.

1. If 1-half of a sheet of paper be worth 1 cent, what is a whole sheet worth?

2. Suppose 2 cents are lying upon the desk before us;—what part of the 2 cents is 1 cent?

3. What part of 2 is 1? 1/2

4. If 1-third of a loaf of bread be worth 1 cent, what is 2-thirds of it worth? What is a whole loaf worth? 3

5. Suppose 3 cents are in a pile before us;—what part of the pile is 1 cent? 1/3 What part of the pile is 2 cents? 2/3

6. What part of 3 is 1? 1/3 What part of 3 is 2? 2

7. If 1-fourth of a yard of ribbon cost 1 cent, what will 2-fourths of a yard cost? 2 What will 3-fourths of a yard cost? 3 What will a whole yard cost? 4

8. Suppose 4 cents are in a pile before us;—what part of the pile is 1 cent? 1/4 is 2 cents? 1/2 is 3 cents? 3/4

9. What part of 4 is 1? 1/4 is 2? 2/4 is 3? 3/4

10. If 1-fifth of a barrel of flour be worth 1 dollar, what is 2-fifths of a barrel worth? 2. 3-fifths of a barrel? 3. 4-fifths of a barrel? 4 What is 1 barrel worth? 5

11. What part of 5 is 1? 1/5 is 2? is 3? 3/5 is 4?

12. If 1-sixth of a yard of ribbon cost 1 cent, what will 2-sixths of a yard cost? 2. 3-sixths of a yard? 3 5-sixths of a yard? 5 What will 1 yard cost? 6

13. What part of 6 is 1? 1/6 is 2? 2/6 is 3? is 4? is 5?

14. If a horse trot 1 mile in 1-seventh of an hour, how many miles will he trot in 2-sevenths of an hour? 2 in 6-sevenths of an hour? 6 How many miles in 1 hour? 7

15. What part of 7 is 1? 1/7 is 2? 2/7 is 3? is 4? is 6? 6/7

16. If 1-eighth of a bar of silver be worth 1 dollar, what is 3-eighths of the bar worth? 3 What is 5-eighths of the bar worth? 5 What is the whole bar worth? 8

17. What part of 8 is 1? 1/8 is 2? 2/8 is 3? 3/8 is 5? 5/8 is 7? 7/8

18 If 1-ninth of a pound of sugar cost 1 cent, what will 2-ninths of a pound cost? 2 What will 8-ninths of a pound? 8 What will 1 pound cost? 9

19. What part of 9 is 1? 1/9 is 2? 2/9 is 4? 4/9 is 6? 6/9 is 8? 8/9

20. If a man can build 1 rod of fence in 1-tenth of a day, how many rods can he build in 4-tenths of a day? 4 in 6-tenths of a day? 6 How many rods in 1 day? 10

21. What part of 10 is 1? 1/10 is 2? 2/10 is 3? 3/10 is 4? 4/10 is 6? 6/10

SECTION 5.

1. A carpenter having sawed a board into halves, finds by measuring, that 1-half of the board is 2 feet long. How long was the whole board? 4

2. Suppose 2 is 1-half of some number,—what is the whole of the number? 4

3. If 1-half of a pound of rice be worth 3 cents, what is a whole pound worth? 6

4. 3 is 1-half of what number? 6 4 is 1-half of what number? 8 7 is 1-half of what number? 14

5. How many times 1-half of any number will make the whole number? 2

6. There is just room for 2 boys to sit upon 1-third of a certain board. What number of boys could sit upon the whole of that board? 6

7. Suppose 2 is 1-third of some number,—what is the whole of the number? 6

8. If 1-third of a box of raisins be worth 3 dollars, what is the whole box worth? 9

9. 3 is 1-third of what number? 9 4 is 1-third of what number? 12 6 is 1-third of what number? 18

10. How many times 1-third of any number will make the whole number? 3

11. If 1-fourth of a yard of broad-cloth cost 2 dollars, what will a yard cost? 8

12. 2 is . fourth of what number? 8

Solution. 2 is 1-fourth of 4 times 2. 4 times 2 is 8

13. If a ship sail 3 miles in 1 fourth of an hour, how many miles will she sail in an hour? 12.

14. 3 is 1-fourth of what number? 4 is 1-fourth of what number? 10 is 1-fourth of what number? 40.

15. How many times 1-fourth of any number will make the whole number? 4.

16. 3 men reaped 1-fifth of a field of wheat in a day. What number of men would have reaped the whole field? 15

Solution. If 3 men reaped 1-fifth, 5 times 3 men would have reaped 5-fifths, or the whole.

17. If 1-fifth of a pound of loaf sugar be worth 4 cents, what is 1 pound worth? 20

18. 4 is 1-fifth of what number? 5 is 1-fifth of what number? 8 is 1-fifth of what number? 40.

19. How many times 1-fifth of any number will make the whole number?

20. 4 sheets of paper is 1-sixth of a quire. How many sheets are there in a quire? 24.

21. 4 is 1-sixth of what number? 2 is 1-sixth of what number? 3 is 1-sixth of what number? 18.

22. How many times 1-sixth of any number will make the whole number?

23. If 1-seventh of a ton of hay be worth 2 dollars, what is a whole ton worth?

24 2 is 1-seventh of what number? 3 is 1-seventh of what number? 9 is 1-seventh of what number?

25. 5 is 1-eighth of what number? 3 is 1-ninth of what number? 6 is 1-tenth of what number? 60.

SECTION 6.

1. If a yard of cloth be worth 2 dollars, what is 1-half of a yard worth? 1 What is 1-half of 2? 1

Observation. Since you know that 1-half of 2 is 1, you will perceive, that 1-half of any other number must be as many times 1 as there are *twos* in the number.

2. What is 1-half of 4? 2 of 12? 6 of 18? 9

3. If a bar of silver weigh 3 pounds, what will 1-third of it weigh? 1 What is 1-third of 3? 1

Observation. Here notice, that 1-third of any number is as many times 1, as there are *threes* in the number.

4. If a peck of oats cost 9 cents what will 1-third of a peck cost ? 3 . What is 1-third of 9 ? 3

5. What is 1-third of 6 ? 2 of 15 ? 5 of 24 ? 8

6. If a man earn 4 shillings in 1 day, how much does he earn in 1-fourth of a day ? 1 What is 1-fourth of 4 ? 1

Observation. Here notice that 1-fourth of any number is as many times 1, as there are fours in the number ?

7. If a pound of raisins cost 20 cents, what will 1-fourth of a pound cost ? 5 What is 1-fourth of 20 ? 5

8. What is 1-fourth of 8 ? 2 of 28 ? 7 of 64 ? 16

9. If a yard of cambric cost 5 dimes, what will 1-fifth of a yard cost ? 1 What is 1-fifth of 5 ? 1

10. If 35 drums of figs will pay for a hogshead of sugar, how many drums will pay for 1-fifth of a hogshead ? 7

11. What is 1-fifth of 35 ? 7 of 25 ? 5 of 40 ? 8

12. If a man earn 6 dollars in a week, how much does he earn in 1-sixth of a week ? 1 What is 1-sixth of 6 ? 1

13. Suppose writing paper costs 24 cents a quire;—what will be the price of 1-sixth of a quire ? 4

Solution. If a quire cost 24 cents, 1-sixth of a quire will cost 1-sixth of 24 cents. 1-sixth of 24 is 4.

14. What is 1-sixth of 12 ? 2 of 36 ? 6 of 48 ? 8

15. What number of days is 1-seventh of a week ? 1

16. If you eat 21 meals in a week, how many do you eat in 1-seventh of a week, or 1 day ? 3

17. What is 1-seventh of 14 ? 2 of 21 ? 3 of 56 ? 8

18. If a melon weigh 8 pounds, what is the weight of 1-eighth of it ? 1 What is 1-eighth of 8 ? 1

19. If a yard of silver wire cost 32 cents, what will 1-eighth of a yard cost ? 4

20. What is 1-eighth of 16 ? 2 of 32 ? 4 of 64 ? 8

21. If a drum of figs weigh 9 pounds, what is the weight of 1-ninth of a drum ? 1 What is 1-ninth of 9 ? 1

22. Suppose a watch-chain consists of 18 links,—how many links are there in 1-ninth of the chain ? 2

23. What is 1-ninth of 18 ? 2 of 36 ? 4 of 72 ? 8

24. What number of cents is 1-tenth of a dime ? 1

25. If a chest of Souchong tea be worth 30 dollars, what is 1-tenth of a chest worth ? 3

26 What is 1-tenth of 30 ? 3 of 50 ? 5 of 100 ? 10

SECTION 7.

Note to Teachers. In solving the following questions, the learner should first state what proportional *part* of the number to be divided will be the answer, and thence proceed to find the answer in the denomination of the dividend.—See solution under example 2d.

1. If any number of oranges should be divided equally between 2 boys, what part of the number would 1 boy receive? What part would 1 boy receive, if the oranges were divided among 3 boys? 4 boys? 5 boys? 6 boys? 7 boys? 8 boys? 9 boys? 10 boys?

2. 5 sailors received 40 dollars, which they divided equally among them. What did 1 sailor receive? 8

Solution. If 5 sailors received 40 dollars, 1 sailor must have received 1-fifth of 40 dollars. 1-fifth of 40 dollars is 8 dollars?

3. 2 fishermen caught 24 fishes, which they shared equally. How many was each man's share? 12

4. If a traveller spend 28 dollars in travelling a week, how much does he spend a day? 4

5. A farmer can keep 9 cows on 36 acres of land:—how many acres would it take to keep 1 cow? 4

6. 3 men have a bill of 30 dollars to pay:—how much must each man pay? 10

7. If a stage run 42 miles in 6 hours, what distance does it run in 1 hour? 7

8. Suppose 8 dozen of biscuit to be worth 72 cents;—what is the value of 1 dozen? 9

9. A tailor made 10 cloaks of 40 yards of cloth. How many yards did he put into each cloak? 4

SECTION 8.

Note to Teachers. Require the learner, as in the last section, to commence every solution by stating what proportional part of the given number is to be taken for the answer.

1. If a man can travel 35 miles in a day, what distance can he travel in 1-seventh of a day? 5 What distance in 4-sevenths of a day? 20

Solution. If he can travel 35 miles in a day, he can travel 1-seventh of 35 miles in 1-seventh of a day; 1-seventh of 35 miles is 5 miles.——He can travel 4 times 5 miles in 4-sevenths of a day; 4 times 5 miles are 20 miles.

2. There are 24 sheets of paper in a quire. How many sheets are there in 1-eighth of a quire ? 3 How many sheets in 3-eighths of a quire ? 9.

3. What is 1-eighth of 24 ? 3 3-eighths of 24 ? 9,

Solution. 1-eighth of 24 is 3; 3-eighths is 3 times 3.

4. If a pound of coffee be worth 15 cents, what is 1-third of a pound worth ? 5 2-thirds of a pound ? 10

5. What is 1-third of 15 ? 5 2-thirds of 15 ? 10

6. If a bushel of barley cost 50 cents, what does 1-fifth of a bushel cost ? 10 4-fifths of a bushel ? 40

7. What is 1-fifth of 50 ? 10 4-fifths of 50 ? 40.

8. If a yard of ribbon cost 28 cents, what will 1-fourth of a yard cost ? 7 3-fourths of a yard ? 21.

9. What is 1-fourth of 28 ? 7 3-fourths of 28 ? 21,

10. If an acre of land will produce 30 bushels of rye, how much will 2-sixths of an acre produce ? 10

Direction. First get what 1-sixth of an acre will yield.

11. What is 5-sixths of 30 ? 25

Direction. First get 1-sixth of 30; thence 5-sixths.

12. If a stage run 81 miles in a day, what number of miles will it run in 7-ninths of a day ? 63

13. What is 7-ninths of 81 ? 63

14. There are 100 cents in a dollar. What number of cents are there in 8-tenths of a dollar ? 80

15. What is 8-tenths of 100 ? 80

16. Albert's kite line was 32 yards long, and he cut off 2-eighths of it for a fish line. What was the length of the fish line ? 8

17. Suppose a boy having 42 quills, should give away 3-sevenths of them;—how many would he give away ?—and how many would he have left ? 18, 24

18. A man having 40 dollars, paid away 3-eighths of his money for a ton of hay. What was the price of the hay ?—and how many dollars had he left ? 15, 25.

19. A boy, who had 45 cents, paid away 3-fifths of his money for a quire of paper. What was the price of the paper ?—and how many cents had he left ? 27, 18,

20. If 75 men can build a mile of fence in a day, what number of men must be employed, to build 2-thirds of a mile in the same time ? 50

SECTION 9.

1. If 48 dollars should be divided equally among 8 men, what part of the money, 3/8 and what number of dollars would 3 men receive? 18

Solution. 3 men would receive 3-eighths of the money. 1-eighth of 48 dollars is 6 dollars; 3-eighths is 3 times 6 dollars, or 18 dollars.

2. A tierce, holding 42 gallons of molasses, bas been emptied into 6 kegs, of equal size. What part of the molasses, 5/6 and what number of gallons in 5 kegs? 35

3. What part of 6 is 5? 5/6 What is 5-sixths of 42? 35

4. If a piece of broad-cloth containing 30 yards will make ten suits of clothes, what part of the piece, 3/5 and what number of yards, will make 6 suits? 18

5. What part of 10 is 6? 6/10 What is 6-tenths of 30? 18

6. 5 girls had 15 oranges, which they shared equally: 2 of the girls gave their shares to a sick woman. What part of 15 oranges did the woman receive? 2/5 and what number of oranges did she receive? 6

7. What part of 5 is 2? 2/5 What is 2-fifths of 15? 6

8. 7 men owned 56 sheep in company, and 3 of the men took out their shares. What part of the flock, 3/7 and what number of sheep did they take out? 24

9. What part of 7 is 3? 3/7 What is 3-sevenths of 56? 24

10. If 4 men eat 28 biscuit in a day, what part of 28 biscuit, 2/4 and what number of biscuit will 2 men eat? 14

11. What part of 4 is 2? 1/2 What is 2-fourths of 28? 14

12. 3 brothers owned 60 acres of land together, and the 2 younger sold their shares to the oldest. What part of the land, 2/3 and how many acres did they sell? 40

13. What part of 3 is 2? 2/3 What is 2-thirds of 60? 40

SECTION 10.

1. If 3 men can fell 18 trees in a day, how many trees can 4 men fell in the same time? 24

Solution. If 3 men can fell 18 trees in a day, 1 man can fell 1-third of 18 trees, or 6 trees; 4 men can fell 4 times 6 trees, or 24 trees.

2. What is 4 times 1-third of 18? 24

Solution. 1 third of 18 is 6: then 4 times 6 is 24.

3. If 5 men will cut 20 cords of wood in a day, how many cords will 3 men cut in the same time? 12

4. What is 3 times 1-fifth of 20? 12.

5. If 4 barrels of flour cost 24 dollars, how much will 7 barrels cost, at the same price per barrel? 42.

6. What is 7 times 1-fourth of 24? 42.

7. If 2 boats will carry 16 passengers across the river, how many passengers will 5 boats carry? 40,

8. What is 5 times 1-half of 16? 40

9. Suppose a cooper can make 27 barrels in 9 days;—how many barrels can he make in 5 days? 15

10. What is 5 times 1-ninth of 27? 15.

11. Suppose 6 kegs will hold 36 gallons of molasses;—what number of gallons will 4 kegs hold? 24.

12. What is 4 times 1-sixth of 36? 24,

13. If 8 soldiers eat 56 pounds of beef in a week, how many pounds will 9 soldiers eat in a week? 63.

14. What is 9 times 1-eighth of 56? 63,

15. If a workman can earn 49 dollars in 7 weeks, how many dollars can he earn in 6 weeks? 42.

16. What is 6 times 1-seventh of 49? 42.

17. If 10 casks of claret wine cost 80 dollars, what would be the price of 8 casks of the same wine? 64,

Section 11.

1. Suppose there are 10 links in 2-thirds of a watch chain;—how many links are there in 1-third of the chain? 5; How many links in the whole chain? 15,

Solution. If there be 10 links in 2-thirds of the chain, there is 1-half of 10 links in 1-third of it: 1-half of 10 is 5.——If 5 links be 1-third of the chain, there are 3 times 5 links in the chain: 3 times 5 is 15.

2. 10 is 2-thirds of what number? 15,

3. If 3-fourths of a pound of honey cost 15 cents, what will 1-fourth cost? 5. What will a pound cost? 20,

4. 15 is 3-fourths of what number? 20,

Solution. Since 15 is 3-fourths of the required number, 1-third of 15 must be 1-fourth of the number: 1-third of 15 is 5. If 5 be 1-fourth of the number, 4 times 5, or 20, is the whole number.

5. If 2-fifths of a bushel of oats cost 18 cents, what will 1-fifth cost? 9. What will a bushel cost? 45.

6. 18 is 2-fifths of what number? 45.

7. If 4-sevenths of a kite line be 36 yards long, how long is 1-seventh? 9 How long is the whole line? 63.

8. 36 is 4-sevenths of what number? 63

9. If 3-sixths of a chest of tea cost 21 dollars, what will 1-sixth cost? 7. What will a whole chest cost? 42.

10. 21 is 3-sixths of what number? 42.

11. If 5-eighths of a pipe of wine be worth 30 dollars, what is the value of the whole pipe? 48.

Direction. First find what 1-eighth is worth.

12. 30 is 5-eighths of what number? 48.

13. If a man can earn 40 cents by working 4-sevenths of a day, how much can he earn by working a whole day?

14. 40 is 4-sevenths of what number?

15. If 7-ninths of a hogshead of sugar be worth 49 dollars, what is the whole hogshead worth? 63.

16. 49 is 7-ninths of what number? 63

17. If a rail-road car run 24 miles in 8-tenths of an hour, what distance will it run in an hour? 30.

18. 24 is 8-tenths of what number? 30.

19. Henry is 10 years old; and his age is equal to 5-sixths of Andrew's age. How old is Andrew? 12.

Suggestion. You may perceive that 1-fifth of Henry's age must be equal to 1-sixth of Andrew's age.

20. 10 is 5-sixths of what number? 12.

21. If 21 workmen will perform 3-fifths of a certain piece of work in a week, what number of workmen would it take to perform the whole work in a week? 35.

22. 21 is 3-fifths of what number? 35.

23. A coach-man purchased a horse, and after paying 5-eighths of the price, he still owed 30 dollars. What was the price of the horse? 80.

Solution. If he paid 5-eighths of the price, the 30 dollars, which he still owed, was 3-eighths of the price. 30 dollars being 3-eighths of the price, 1-third of 30 dollars, or 10 dollars, is 1-eighth. 10 dollars being 1-eighth of the price, 8 times 10 dollars is the price.

24. 30 is 3-eighths of what number? 80.

25. If 2-fifths be taken from the whole of any thing, how many fifths are there left? 3.

26. While George was fishing, a pickerel broke off 2-fifths of his line; he then had 12 feet of the line left. How long was his line at first? 20

27. Suppose a laborer can earn 60 cents a day, by working 5-sixths of the time;—how much could he earn by working constantly? 72

28. After 3-sevenths of a cask of wine had leaked out, the owner drew off the remainder, and found there were 48 gallons. How many gallons had he lost? 84

29. A farmer improved 3-ninths of his farm in tillage, appropriated 4-ninths to pasturage, and had 18 acres of wood-land. How many acres had he in all? 81

30. 2-eighths of Edward's books are bound in leather, 3-eighths of them in marble paper, and 15 of them in blue paper. How many has he of each description?

SECTION 12.

Note to Teachers. This section embraces all the operations taught in the preceding sections of this chapter. Prefixed to each example, is the number of the section in which the operation involved in the example is taught. If the pupil fail in any part of this section, he should be put back to the section whose number is prefixed to the example in which he fails.

REVIEW.

1. (§ 1.) James found 4-eighths of a dollar, and earned 5-eighths. How much money had he then?

2. (§ 2.) If we divide any thing into 6 equal parts, and take away 4 parts, how much of the thing is left?

3. (§ 3.) If you have 7-ninths of 1 dollar, what part of a dollar must you get to make up 1 dollar?

4. (§ 4.) If a man can walk 1 mile in 1-fourth of an hour, how many miles can he walk in 1 hour? 4

5. (§ 4.) What part of 6 is 5? What part of 7 is 3? What part of 10 is 4? What part of 18 is 7?

6. (§ 5.) If 1-fourth of an acre of land will produce 9 bushels of corn, how much will 1 acre produce?

7. (§ 5.) If 1-eighth of a barrel of beef be allowed to 3 soldiers for a week's provision, what number of soldiers will 1 barrel supply for a week?

8. (§ 6.) Suppose a yard of gold wire to be worth 28 dollars;—what is 1-fourth of a yard worth? 7.

9. (§ 7.) If 50 day's work is to be done by 5 men, how many day's work must each man perform? 10.

10. (§ 8.) If one pound of Hyson tea be worth 96 cents, what is 7-eighths of a pound worth? 84.

11. (§ 9.) A company of 14 men gave 84 dollars for a boat. What part of 84 dollars did 5 men pay? 30.

12. (§ 9.) If 8 dollars will buy 72 pounds of brown sugar, how many pounds will 6 dollars buy? 54.

13. (§ 10.) Suppose 18 yards of cloth will make 6 coats;—how many yards are required for 10 coats? 30.

14. (§ 11.) If 5-ninths of a yard of cotton cambric be worth 50 cents, what is the value of one yard? 90.

15. (§ 11.) Suppose a man by working constantly can dig 40 bushels of potatoes in a day,—how many bushels will he dig, if he be idle 2-fifths of the day? 24.

FRACTIONS AND RELATIONS.

SECTION 13.

Note to Teachers. The *remainders*, that will arise in the several examples of division in this section, must be expressed in the language of fractions. See answers under examples 4th. and 8th. If the learner should not readily understand the process of converting the remainders into fractions, he may be referred to section 4th. in this chapter, and, after reviewing the examples therein, may return immediately to this section.

1. How much cloth, at 2 dollars a yard, can I buy for 1 dollar? How much for 3 dollars? 1/2 . 1 1/2

2. What part of 2 is 1? How many times 2 in 3?

3. How many yards of ribbon, at 2 cents a yard, can you buy for 7 cents? 3 1/2 I mean,—how many whole yards, and what part of another yard can you buy? 3 1/2.

4. How many times 2 in 7?—I mean,—how many *twos* are there, and what part of 1 more *two*, in 7?

Solution. 2 is contained in 7, 3 times, and 1 over: the 1 over is 1-half of another time 2. *Ans.* 3 and 1-half.

5. How many times 2 in 9? 4 1/2 in 12? 6 in 13? 6 1/2

6. How much wine, at 3 dollars a gallon, can I buy for 1 dollar? 1/3 How much for 4 dollars? 1 1/3.

What part of 3 is 1? 1/3 How many times 3 in 4? 1 1/3

8. If a girl by setting types can earn 1 dollar in 3 days, how much can she earn in 20 days?

Solution. She can earn as many dollars as there are threes in 20. 3 in 20, 6 times and 2 over; the 2 over is 2-thirds of another *three.* *Ans.* 6 dollars and 2-thirds.

9. How many times 3 in 4? in 16? in 20?

10. If a pound of lead cost 4 cents, how much can I buy for 1 cent? How many pounds for 9 cents?

11. If it take a man 1 hour to walk 4 miles, how many hours will it take him to walk 15 miles?

12. How many times 4 in 9? in 15? in 34?

13. How much coal, at 5 dollars a ton, can be bought for 1 dollar? How much for 7 dollars?

14. How many hogsheads of salt, at 5 dollars a hogshead, can be bought for 44 dollars?

15. How many times 5 in 7? in 44? in 58?

16. How much ribbon, at 6 cents a yard, can you buy for 10 cents? How much for 37 cents?

17. If it cost 6 cents a mile to ride in the stage, what number of miles can you ride for 50 cents?

18. How many times 6 in 10? in 50? in 45?

19. How much sugar, at 7 cents a pound, can I buy for 9 cents? How much for 52 cents?

20. How many pounds of shot, at the rate of 7 cents a pound, must be sold for 34 cents?

21. How many times 7 in 9? in 52? in 34?

22. How much hay, at 8 dollars a ton must be sold for 9 dollars? How much for 29 dollars?

23. How many pounds of honey, at the rate of 8 cents a pound, must be sold for 77 cents?

24. How many times 8 in 9? in 29? in 77?

25. At 9 cents a pound, how much cheese must be sold for 13 cents? How much for 31 cents?

26. If a man work for 9 cents an hour, how many hours will it take him to earn 64 cents?

27. How many times 9 in 13? in 31? in 64?

28. How much sugar, at 10 cents a pound, can be bought for 12 cents? How much for 64 cents?

29. If a workman can build 10 rods of fence in 1 day, how many days will it take him to build 48 rods?

30. How many times 10 in 12? in 64? in 48?

31. How much rice at 3 cents a pound, must be given for 4 quarts of milk at 5 cents a quart?

Direction. First find the value of 4 quarts of milk.

32. How many times 3 in 4 times 5?

Direction. First find how much 4 times 5 is.

33. How many pounds of flour at 4 cents a pound, must be given for 5 pounds of honey at 7 cents a pound?

34. How many times 4 in 5 times 7?

35. What quantity of butter at 10 cents a pound, will pay for 6 combs at 8 cents apiece?

36. If an active man earn 7 shillings a day, and a lazy man 4 shillings, how many days must the lazy man work, to pay the active man for working 6 days?

37. How many times 4 in 6 times 7?

38. How many yards of cloth at 5 dollars a yard, will pay for 3 boxes of raisins at 9 dollars a box?

39. How many times 5 in 3 times 9?

40. What quantity of corn at 6 dimes a bushel, will pay for 11 bushels of oats at 3 dimes a bushel?

41. How many times 6 in 11 times 3?

SECTION 14.

Note to Teachers. The learners must now be led to observe, that the expressions, 1-*half*, 1-*third*, 2-*thirds*, &c. are to be understood,—1-half of *one*. 1-third of *one*, 2-thirds of *one*, &c. in all cases where the number, of which the fraction indicates a part, is not stated.

1. If I should cut each of 3 sheets of paper into halves, how many halves would they make?

Solution. In 1 sheet there are 2-halves,—in 3 sheets there are 3 times 2-halves, or 6-halves.

2. How many halves are there in 1? in 2? in 3?

3. If I had 4 sheets and 1-half of a sheet of paper, how many boys could I supply with half a sheet apiece?

4. How many halves are there in 4 and 1-half?

5. If 2 slate pencils should each of them be broken into thirds, how many thirds would they make?

6. How many thirds are there in 1? in 2? in 4?

7. Suppose I had 3 pencils and 2-thirds, how many boys could I supply with 1-third of a pencil each? 11

8. How many thirds are there in 3 and 2-thirds?

9. If 1-fourth of a yard of cloth will make a satchel, how many satchels will 2 yards make? 8

10. How many fourths are there in 1? 4 in 2? 8 in 3? 12.

11. How many quires of paper, at 1-fourth of a dollar a quire, can you buy for 3 dollars and 2-fourths? 14

Solution. I can buy as many quires as there are fourths of a dollar, in 3 dollars and 2-fourths. In 1 dollar there are 4-fourths,—in 3 dollars, 3 times 4-fourths, or 12-fourths: 12-fourths plus 2-fourths is 14-fourths.

12. If a carpenter use 1-fifth of a board to make 1 book shelf, how many book shelves can he make of a whole board? 5 of 2 whole boards? 10 of 2 boards and 3-fifths? 13. of 4 boards and 1-fifth? 21.

13. How many fifths are there in 1? 5 in 2? 11 in 2 and 3-fifths? 13 In 4 and 1-fifth? 21.

14. If a bunch of quills cost 1-sixth of a dollar, how many bunches can you buy for 1 dollar? 6 for 1 dollar and 5-sixths? 11 for 3 dollars and 2-sixths?

15. How many sixths are there in 1? in 1 and 5-sixths? 11 in 3 and 2-sixths? 20

16. If a stage run 1 mile in 1-seventh of an hour, what number of miles will it run in 1 hour? 7 in 2 hours and 1-seventh? 15 in 4 hours and 4-sevenths?

17. How many sevenths are there in 1? 7 in 2 and 1-seventh? 15 in 4 and 4-sevenths? 32

18. At 1-eighth of a dollar a yard, how many yards of ribbon can I buy for 1 dollar and 3-eighths? 11 for 2 dollars? 16 for 5 dollars and 7-eighths?

19. How many eighths are there in 1 and 3-eighths? 11 in 2? 16 in 5 and 7-eighths? 47

20. How many ninths are there in 1? 9 in 1 and 4-ninths? 13 in 2? 18 in 2 and 7-ninths? 25 in 6?

21. How many tenths are there in 1? 10 in 4? in 3 and 5-tenths? in 5? in 8 and 3-tenths?

22. A laborer earned 9 dollars and a half, working at half a dollar a day. How many days did he work?

23. If 1-eighth of a yard of cloth cost a dollar, what will 3 yards and 6-eighths cost? 30

24. If a man earn a dollar in 1-sixth of a week, how much can he earn in 8 weeks and 4-sixths?

25. If it take 1-fifth of a pound of fur to make a hat, how many hats can be made of 4 pounds and 2-fifths? 22

26. If 1-fourth of a yard of lace cost a dollar, how much will 5 yards and 3-fourths of a yard cost? 23

Section 15.

1. How many dollars in 2-halves of a dollar? in 3-halves of a dollar? *Ans.* 1 dollar. 1 dollar and 1-half.

2. How many dollars are there in 4 half dollars? in 5 half dollars? in 9 half dollars?

3. How many whole ones in 2-halves? in 3-halves? in 4-halves? in 5-halves? in 9-halves?

4. What will 13 pencils cost, at half a cent apiece?

5. If 3-thirds of an orange be put together they make up 1 orange. Now, if you had 6-thirds of an orange, how many oranges could you make up? if you had 10-thirds? if you had 17-thirds?

6. How many whole ones in 6-thirds? in 10-thirds? in 17-thirds?

7. What cost 26 quills, at 1-third of a cent apiece?

Solution. If 1 quill cost 1-third of a cent, 26 quills will cost 26-thirds of a cent. 26-thirds of a cent are as many cents as 3 is contained times in 26. 3 in 26, 8 times and 2 over. *Ans.* 8 cents and 2-thirds.

8. How many whole apples could you make up, if you had 5-fourths of an apple? 14-fourths of an apple?

9. What cost 31 cups, at 1-fourth of a dollar apiece?

10. How many whole ones in 5-fourths? in 14-fourths? in 31-fourths?

11. If 1 cotton ball be given for 1-fifth of a yard of galloon, how much galloon must be given for 8 cotton balls? for 17 cotton balls? for 44 cotton balls?

12. How many whole ones are there in 8-fifths? in 17-fifths? in 44-fifths?

13. If a quire of paper cost 1-sixth of a dollar, what is the cost of 12 quires? 17 quires? 19 quires?

14. How many whole ones in 12-sixths? in 17-sixths? in 19-sixths?

15. How many whole ones in 18-sevenths? in 24-tenths? in 31-eighths? in 47-ninths? in 25-fourths?

SECTION 16.

1. Ellen paid, for the *Young Ladies' Class Book*, 3-fourths of a dollar; for the *Boston School Atlas*, 2-fourths of a dollar; and for the *National Spelling-Book*, 1-fourth of a dollar. What did the whole cost? 1 1/2.

2. How much is 3-fourths and 2-fourths and 1-fourth? 6

3. A trader sold a piece of cloth for 19 dollars and 5-eighths, and a hat for 4 dollars and 7-eighths. How many dollars did he receive for both? 24 1/2

Solution. 19 dols. plus 4 dols. are 23 dols. 5-eighths of a dol. plus 7-eighths of a dol. are 12-eighths of a dol., equal to 1 dol. and 4-eighths. Then, 23 dols. plus 1 dol. and 4-eighths are 24 dols. and 4-eighths.

4. A traveller rode 31 miles and 3-fifths in the forenoon, and 25 miles and 4-fifths in the afternoon. How many miles did he ride in the whole day? [illegible]

5. What is 31 and 3-fifths plus 25 and 4-fifths? 57 2/5

6. A trader bought some goods for 64 dollars and 5-sevenths, and paid 5 dollars and 3-sevenths for the postage of them. What was the whole expense? 70 1/7

7. What is 64 and 5-sevenths plus 5 and 3-sevenths? 70 1/7

8. A gentleman paid 33 dollars and 7-tenths for some cloth, and 11 dollars and 6-tenths for having it made into a suit of clothes. What did the suit cost? 4[illegible]

9. What is 33 and 7-tenths plus 11 and 6-tenths? [illegible]

10. What is 16 and 6-ninths plus 8 and 5-ninths? 25 [illegible]

11. What is 40 and 5-sixths plus 41 and 3-sixths? 82 2/6.

SECTION 17.

1. Suppose a rail-road car to run 2-thirds of a mile in 1 minute, what distance will it run in 10 minutes? 6 2/3

Solution. In 10 minutes it will run 10 times 2-thirds of a mile, or 20-thirds of a mile 20-thirds of a mile are equal to 6 miles and 2-thirds.

2. If 3-fourths of a gallon of wine leak out of a cask in 1 hour, how much will leak out in 7 hours? 5 1/4.

3. How many whole ones in 7 times 3-fourths? 5 1/4.

4. If a yard of cambric muslin cost 4-fifths of a dollar, how much will 9 yards cost? 7 1/5.

5. How many whole ones in 9 times 4-fifths? 7 1/5.

6. Suppose a man to eat 5-sixths of a pound of beef in one day, how many pounds will he eat in 5 days? 4 1/6.

7. How many whole ones in 5 times 5-sixths? 4 1/6.

8. If 3-sevenths of a pound of gunpowder tea cost 1 dollar, how many pounds can I buy for 8 dollars? 3 3/7.

9. How many whole ones in 8 times 3-sevenths? 3 3/7.

10. Suppose 5-eighths of a yard of cloth will make a vest, how many yards will it take to make 6 vests? 3 6/8.

11. How many whole ones in 6 times 5-eighths? 3 6/8.

12. If 1 quire of letter paper be worth 4-ninths of a dollar, how many dollars are 7 quires worth? 3 1/9

13. How many whole ones in 7 times 4-ninths? 3 1/9.

14. Suppose a man to walk 1 mile in 2-tenths of an hour, what time will it take him to walk 9 miles? 1 8/10.

15. How many whole ones in 9 times 2-tenths? 1 8/10.

SECTION 18.

1. What will 6 yards of broad-cloth cost, at 7 dollars and 3-eighths of a dollar per yard? 44 2/8.

Solution. 6 yards will cost 6 times 7 dollars and 3-eighths. 6 times 7 dollars are 42 dollars. 6 times 3-eighths are 18-eighths, equal to 2 and 2-eighths. Then, 42 dollars plus 2 dollars and 2-eighths are 44 dollars and 2-eighths.

2. What will 4 hundred-weight of sugar cost, at 9 dollars and 2-fifths per hundred-weight? 37 3/5

3. What is 4 times 9 and 2-fifths? 37 3/5

4. Suppose a ship to sail 10 miles and 1-half in one hour, what distance will it sail in 7 hours? 73 1/2

5. What is 7 times 10 and 1-half? 73 1/2

6. If a horse eat 1 bushel and 9-tenths of a bushel of oats in a week, how much will he eat in 4 weeks? 7 6/10.

7. What is 4 times 1 and 9-tenths? 7 6/10.

8. If 1 dime will buy 3 yards and 2-thirds of a yard of ribbon, how many yards will 6 dimes buy? 22.

9. What is 6 times 3 and 2-thirds? 22.

10. Suppose the price of coal at the mine, is 3 dollars a ton, and the freight of it to the city is 3-fourths of a dollar a ton, what will 10 tons cost at the city? 37 1/2.

11. What is 10 times 3 and 3-fourths? 37 2/4.

12. Suppose a boat goes 10 miles and 5-sixths of a mile in 1 hour; what distance will it go in 8 hours? 86 4/6

13. What is 8 times 10 and 5-sixths? 86 4/6

14. If 3 yards and 7-eighths of cloth will make a cloak, how many yards will it take to make 5 cloaks? 19 3/8

15. What is 5 times 3 and 7-eighths? 19 3/8

Section 19.

1. If 1-fifth of a chest of tea be worth 6 dollars and 7-eighths, what is a whole chest worth? 34 3/8

Solution. A whole chest is worth 5 times as much as 1-fifth of a chest. 5 times 6 dollars are 30 dollars; 5 times 7-eighths of a dollar are 35-eighths of a dollar, or 4 dollars and 3-eighths. 30 dollars plus 4 dollars and 3-eighths are 34 dollars and 3-eighths.

2. 6 and 7-eighths is 1-fifth of what number? 34 3/8

3. Suppose 1-ninth of a kite line to be 5 yards and 3-fourths of a yard long,—how long is the whole line? 51 3/4

4. 5 and 3-fourths is 1-ninth of what number? 51 3/4

5. A young man being asked his age, answered indirectly, that 1-third of his age was 7 years and 2-sixths of a year. What was his age? 22

6. 7 and 2-sixths is 1-third of what number? 22

7. Suppose a man can build 3 rods and 2-fifths of a rod of wall in 1-sixth of a week,—how many rods can he build in a whole week? 20 [illegible]

8. 3 and 2-fifths is 1-sixth of what number? [illegible]

9. If 1-tenth of a bushel of corn be worth 6 cents and 1-fourth of a cent, what is a bushel worth? 62 [illegible]

10. 6 and 1-fourth is 1-tenth of what number? [illegible]

11. 1-fourth of Edmund's kite line measures 8 yards and 3-sevenths of a yard. How long is the line? 33 [illegible]

12. 8 and 3-sevenths is 1-fourth of what number? [illegible]

13. If 1-half of a yard of lace cost 3 dollars and 4-fifths of a dollar, what will a yard cost? [illegible]

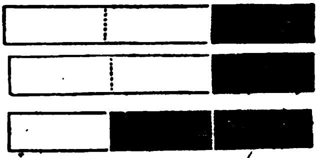
14. 3 and 4-fifths is 1-half of what number? [illegible]

15. Suppose that 1-seventh of an acre of land will produce 6 bushels and 7-ninths of a bushel of barley how many bushels will an acre produce? [illegible]

16. 6 and 7-ninths is 1-seventh of what number?

SECTION 20.

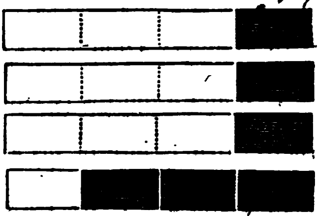
1. If 1 apple were divided equally among 3 boys, what part of 1 apple would 1 boy receive? 1/3 If 2 apples were thus divided, how many thirds would one boy receive? 2/3



2. Here we see 1-third of 2 boards, placed over 2-thirds of 1 board. Is it not plain, that 1-third of the 2 boards together, is equal to 2-thirds of 1 board?

3. 1-third of 2 is equal to what part of 1? 2/3.

4. There were 3 boys, who had 1 dollar apiece; and each boy gave a decrepit soldier 1-fourth of his money. What part of 1 dollar did the poor soldier receive? 3/4



5. Here, we see 1-fourth of 3 boards placed over 3-fourths of 1 board. Suppose the fourths seen in the 3 boards should be placed together end to end—Is it not plain, they would make 3-fourths of 1 board?

6. 1-fourth of 3 is equal to what part of 1? 3/4.

7. I have 4 oranges to divide among 5 boys.—I first cut 1 orange into fifths, and give each boy 1-fifth; and thus I proceed, dividing 1 orange at a time, until they are all divided. Now, what part of a whole orange can each boy make up, by joining his fifths together? 4/5

8. 1-fifth of 4 is equal to what part of 1? 4/5

9. If 1 melon were divided equally among 6 boys, what part of 1 melon would 1 boy receive? If 2 melons were divided, how many sixths would 1 boy receive? 2/6

10. 1-sixth of 2 is equal to what part of 1? 2/6.

11. If 3 barrels of flour were divided equally among 7 men, how much would 1 man receive? 3/7

12. 1-seventh of 3 is equal to what part of 1? 3/7

13. If 3 pounds of beef were divided equally among 8 soldiers, what part of a pound would 1 soldier get? 3/8

14. 1-eighth of 5 is equal to what part of 1? 1/8.

15. An ostler has 2 bushels of oats to divide among 9 horses;—how much must he give to each horse? 2/9

16. 1-ninth of 2 is equal to what part of 1? 1/4.

17. If 7 dollars were divided equally among 10 men, what part of 1 dollar would each man have? 7/10.

18. 1-tenth of 7 is equal to what part of 1? 7/10

19. 1-fourth of 2 is equal to what part of 1? 2/4

20. 1-sixth of 5 is equal to what part of 1? 5/6

21. 1-eighth of 3 is equal to what part of 1? 3/8.

22. There were 36 oranges in a basket and Albert was directed to take 1-fourth of them. Accordingly he cut 1-fourth out of every orange, and took it to himself. How many fourths of an orange did he get? [illegible] He then joined his fourths together, to make them into whole oranges;—how many whole ones had he? 9.

23. 1-fourth of 36 is equal to how many fourths of 1? —equal to how many whole ones?

24. In another basket there were also 36 oranges, and Benjamin was directed to take 1-fourth of them. But, instead of cutting 1-fourth out of every orange, as Albert did, he took 1 orange from every 4 in the basket. How many oranges did Benjamin get? 9.

25. Now tell me which is the most;—1-fourth of 36, or 36-fourths of 1?

26. 1-half of 10 dollars is equal to how many halves of 1 dollar? 10 equal to how many dollars? 5

27. 1-third of 18 oranges is equal to how many thirds of 1 orange? 6 equal to how many whole oranges? 6.

28. 1-fifth of 17 oranges is equal to how many fifths of 1 orange? 17 equal to how many whole oranges? 3 2/5

29. 1-sixth of 42 is equal to how many sixths of 1? —equal to how many whole ones? 7.

30. 1-seventh of 56 is equal to how many sevenths of 1? 8 equal to how many whole ones? 8.

SECTION 21.

1. If a chest of green tea be worth 27 dollars, what is 1-fourth of it worth? 6 3/4

Solution. 1-fourth of the tea is worth 1-fourth of 27 dollars. 1-fourth of 27 dollars is 6 dollars, there being

3 dollars over. 1-fourth of 3 dollars is equal to 3-fourths of 1 dollar. 6 dollars plus 3-fourths of a dollar are 6 dollars and 3-fourths...... Or, we may say,—One fourth of 27 dollars is 27-fourths of 1 dollar; equal to 6 dollars and 3-fourths.

2. What is 1-fourth of 27? 6 3/4

3. 3 men bought a barrel of sugar for 23 dollars, and divided it equally among them, each man taking 1-third of the sugar, and paying 1-third of the price. How many dollars did each man pay? 7 2/3

4. What is 1-third of 23? 7 2/3

5. Suppose a family to eat 26 loaves of bread in a week;—what number of loaves would the family consume in 1-seventh of a week, or 1 day? 3 5/7

6. What is 1-seventh of 26? 3

7. Suppose 48 bushels of wheat are to be divided among 5 men; how much will 1 man receive? 9. 3/5

8. What is 1-fifth of 48? 9 3/5

9. 6 men purchased a boat for 27 dollars: each man paid 1-sixth of the money, and owned 1-sixth of the boat. How many dollars did 1 man pay? 4 3/6

10. What is 1-sixth of 27? 4 3/6

11. Suppose a bag of coffee to weigh 65 pounds;—what is the weight of 1-ninth of it? 7 2/9

12. What is 1-ninth of 65? 7 2/9

13. If it will take a man 60 days to clear a piece of wood-land, in what time will he clear 1-eighth of it? 7 1/2

14. What is 1-eighth of 60? 7 1/2

15. A sailor was cast upon a desolate island, and subsisted 10 days upon 34 biscuit, eating an equal quantity each day. How many did he eat each day? 3 4/10

16. What is 1-tenth of 34? 3 4/10

17. If a bar of silver, that is worth 37 dollars, should be cut into 3 equal parts, how many dollars would 1 of the parts be worth? 12 1/3

18. What is 1-third of 37? 12 1/3

19. Suppose a party of 9 gold hunters find a quantity of ore, which is worth 88 dollars; what is the value of each man's share? 5 7/9

20. What is 1-ninth of 88? 9 7/9

21. If it take a man 4 months to earn 38 dollars, how much does he earn in 1 month? 9 1/2.

22. What is 1-fourth of 38? 9 1/2.

23. If 6 barrels of superfine flour cost 35 dollars, what is the price of 1 barrel of it? 5 5/6

24. What is 1-sixth of 35? 5 5/6.

25 Suppose 39 bushels of corn to grow upon 1 acre;—how much corn will 1-fifth of an acre produce? 7 4/5

26. What is 1-fifth of 39? 7 4/5.

27. If 2 dollars will pay for 13 pounds of butter, how many pounds can be bought for 1 dollar? 6 1/2

28. What is 1-half of 13? 6 1/2

29. If 8 dollars will pay for 78 pounds of cheese, how many pounds will 1 dollar pay for? 9 6/8

30. What is 1-eighth of 78? 9 6/8

31. Suppose 10 men drink 55 gallons of beer in a month;—how much will 1 man drink in a month? 5 1/2

32. What is 1-tenth of 55? 5 1/2

33. Suppose 7 acres of land to produce 60 dollars' worth of hay;—what is the value of the hay which 1 acre of the land produces? 8 4/7

34. What is 1-seventh of 60? 8 4/7

35. If 1 man can clear a piece of wood-land in 29 days, in what number of days would 5 men clear it? 5 4/5.

Instruction. Consider that 5 men can do 5 times as much work in a day, as 1 man can do: consequently, it will take 5 men only 1-fifth of the time that it will take 1 man to clear the land.

36. How many days will it take 7 men to do a piece of work, that 1 man can do in 46 days? 6 4/7

37. If 1 man will drink a firkin of beer in 50 days, how many days will it last 6 men? 8 2/6

38. Suppose 24 men can hoe a piece of corn in 1 day; what number of men must be employed to hoe it in 8 days? 3.

Suggestion. Each man, that shall be employed, can do 8 times as much work in 8 days, as he can in 1 day.

39. If 40 men can build a wall in 1 day, what number of men must be employed to build it in 4 days? 10.

40. If a cistern can be discharged by 1 faucet in 19 hours, in what time can it be discharged by 3 faucets? 6

SECTION 22.

1. If a smith can make 5 cups from 12 ounces of silver, how much silver is required to make 3 cups? 7 1/5.

Direction. First find how much silver would make 1 cup; then, 3 times that quantity would make 3 cups.

2. What is 3 times 1-fifth of 12? 7 1/5.

Solution. 1-fifth of 12 is 2 and 2-fifths. 3 times 2 is 6; 3 times 2-fifths is 6-fifths, or 1 and 1-fifth. Then 6 plus 1 and 1-fifth is 7 and 1-fifth.

3. If 22 bushels of wheat will make 4 barrels of flour, how much wheat will make 6 barrels of flour? 33.

4. What is 6 times 1-fourth of 22? 33.

5. Suppose the equipments for 8 soldiers to cost 75 dollars; what would be the expense of equipping 5 soldiers? 46 7/8.

6. What is 5 times 1-eighth of 75? 46 7/8.

7. If 29 tons of hay will keep 9 horses through the winter, how many tons would 6 horses require? ~~18~~ 19 1/3.

8. What is 6 times 1-ninth of 29? 19 1/3.

9. Suppose 7 acres of pasturage to be worth 65 dollars; what is 3 acres of the same pasturage worth? 27 6/7

10. What is 3 times 1-seventh of 65? 27 6/7.

11. If 8 acres of pasturage will keep 35 sheep, how many sheep would be sufficient to for 6 acres? 26 2/8.

12. What is 6 times 1-eighth of 35? 26 2/8.

13. Suppose a man to eat 50 pounds of beef in 8 weeks; what number of pounds would he eat in 9 weeks? 56 1/4

14. What is 9 times 1-eighth of 50? 56 1/4

15. If it take 36 yards of broad-cloth to make 10 suits of clothes, how many yards would make 4 suits? 14 4/10.

16. What is 4 times 1-tenth of 36? 14 4/10

17. A trader gave 59 dollars for 9 barrels of flour, and sold 3 barrels of it, at the same price per barrel that he gave. For how much did he sell the 3 barrels? 16 3/9.

18. What is 3 times 1-ninth of 59? 16 3/9.

19. If 6 pounds of brown sugar be sold for 52 cents, what would be the price of 5 pounds of it? 43 2/6.

20. What is 5 times 1-sixth of 52? 43 2/6.

21. If 8 scholars use 18 quires of paper in a month, how many quires would 10 scholars use in a month? 22 1/2.

22. What is 10 times 1-eighth of 18? 22 1/2.

23. Suppose a stage to run 58 miles in 7 hours; what distance does it run in 6 hours? 49 5/7

24. What is 6 times 1-seventh of 58? 49 5/7.

25. If a mill grind 17 bushels of corn in 2 hours, how many bushels will it grind in 7 hours? 59 1/2

26. What is 7 times 1-half of 17? 59 1/2

27. Albert paid 61 cents for 9 writing-books, and William bought 7 writing-books, paying at the same rate. How much did William's books cost him? 48 1/9

28. What is 7 times 1-ninth of 61? 43 /9

29. Suppose a hunter gets 8 pounds of gunpowder in exchange for 44 pounds of venison; how many pounds of venison must he give for 10 pounds of powder? 55,

30. What is 10 times 1-eighth of 44? 55

Section 23.

1. When writing paper is sold at 20 cents a quire, what is the price of 1-third of a quire? 6 2/3.

2. If 1-third of a quire of paper is worth 6 cents and 2-thirds, what is 2-thirds of a quire worth? 13 1/3,

3. What is 1-third of 20? 2-thirds of 20? 6 2/3. 13 1/3.

4. Suppose a yard of ribbon to be worth 23 cents; what is 1-fourth of a yard worth? 5 3/4.

5. If 1-fourth of a yard of ribbon is worth 5 cents and 3-fourths, what is 2-fourths of a yard worth? 11 2/4.

Solution. 2-fourths of a yard is worth 2 times 5 cents and 3-fourths. 2 times 5 cents are 10 cents; 2 times 3-fourths of a cent are 6-fourths of a cent, or 1 cent and 2-fourths. 10 cents plus 1-cent and 2-fourths, are 11 cents and 2-fourths.

6. What is 1-fourth of 23? 2-fourths of 23? 5 3/4 11 2/4,

7. Suppose a pound of white sugar to be worth 23 cents; what is 1-fifth of a pound worth? 4 3/5

8. If 1-fifth of a pound of sugar is worth 4 cents and 3-fifths, what is 3-fifths of a pound worth? 13 4/5 –

9. What is 1-fifth of 23? 3-fifths of 23? 4 3/5: 13 4/5:

Solution. 1-fifth of 23 is 4 and 3-fifths...... 3-fifths of 23 is 3 times 4 and 3-fifths. 3 times 4 is 12: 3 times 3-fifths are 9-fifths, or 1 and 4-fifths. 12 plus 1 and 4-fifths is 13 and 4-fifths.

10. Suppose a man can walk 34 miles in a day, what distance can he walk in 1-sixth of a day? 5 4/6

11. If a man walk 5 miles and 4-sixths, in 1-sixth of a day, how far will he walk in 5-sixths of a day? 25

12. What is 1-sixth of 34? 5 4/6 5-sixths of 34? 28 2/6.

13. Suppose a bushel of corn to be worth 65 cents; what is 1-seventh of a bushel worth? 9 2/7

14. If 1-seventh of a bushel of corn cost 9 cents and 2-sevenths, what will 3-sevenths of a bushel cost? 27 6/7

15. What is 1-seventh of 65? 9 2/7 3-sevenths of 65? 27 6/7.

16 Suppose 1 dollar will pay for 35 pounds of rice; how much rice will 1-eighth of a dollar buy? 4 3/8

17. If 1-eighth of a dollar will buy 4 pounds and 3 eighths, how much will 5-eighths of a dollar buy? 21 7/8

18. What is 1-eighth of 35? 4 3/8 5-eighths of 35? 21 7/8

19. Suppose a man earns 70 cents a day; how much does he earn in 1-ninth of a day? 7 7/9

20. If a man can earn 7 cents and 7-ninths, in 1-ninth of a day, how much can he earn in 8-ninths of a day? 62 2/9

21. What is 1-ninth of 70? 7 7/9 8-ninths of 70? 62 2/9

22. Suppose an acre of land will produce 43 bushels of oats; what will 1-tenth of an acre produce? 4 3/10

23. If 1-tenth of an acre produce 4 bushels and 3-tenths, what will 7-tenths of an acre produce? 30 1/10

24. What is 1-tenth of 43? 4 3/10 7-tenths of 43? 30 1/10.

25. If a yard of cloth will pay for 30 pounds of cheese, how many pounds will 3-fourths of a yard buy? 22 1/2

Direction. First find how many pounds 1-fourth of a yard will pay for.

26. A farmer sold 4-fifths of a ton of hay, for oats, allowing 32 bushels of oats to be worth the same as a ton of hay. How many bushels of oats did he receive? 25 3/5

27. What is 4-fifths of 32? 25 3/5

28. Suppose 1 dollar will pay for 38 pounds of rice; for how many pounds will 8-tenths of a dollar pay? 30 4/10.

29. What is 8-tenths of 38? 30 4/10

30. A man bought a piece of land containing 1 acre and 4-sixths, and paid at the rate of 40 dollars per acre. How much did he pay for the land? 66 4/6

31. What is 40 plus 4-sixths of 40? 66 4/6

SECTION 24.

1. Suppose 3-fourths of a yard of flannel to cost 32 cents; what does 1-fourth of a yard cost? What would a yard cost? 42 2/3.

Solution. If 3-fourths of a yard cost 32 cents, 1 fourth of a yard costs 1-third of 32 cents. 1-third of 32 cents is 10 cents and 2-thirds of a cent...... 4-fourths, or a whole yard would cost 4 times 10 cents and 2-thirds 4 times 10 cents are 40 cents; 4 times 2-thirds are 8-thirds, equal to 2 and 2-thirds. Then, 40 cents plus 2 cents and 2-thirds are 42 cents and 2-thirds.

2. 32 is 3-fourths of what number? 42 2/3

Solution. Since 32 is 3-fourths of the number, 1-third of 32 is 1-fourth of it. 1-third of 32 is 10 and 2-thirds. 4 times 10 and 2-thirds are 42 and 2-thirds.

3. If 2-fifths of an acre of land will produce 9 bushels of rye; how many bushels will 1-fifth of an acre produce 4 1/2 How many bushels will an acre produce? 22 1/2

4. 9 is 2-fifths of what number? 22 1/2

Instruction. Observe, that 1-half of 9 must be 1-fifth of the required number.

5. If a man drink 6 gallons of beer in 5-sixths of a month, how many gallons does he drink in 1-sixth of a month? 1 1/5 How many gallons will he drink in a month? 7 1/5

6. 6 is 5-sixths of what number? 7 1/5

7. A man, who spends 42 cents a day, finds his expenses to be 5-sevenths of his wages. What is 1-seventh of his wages? 8 2/5 What is the whole of his wages? 58 4/5

8. 42 is 5-sevenths of what number? 58 4/5

9. If 5-eighths of a dollar will pay for 24 pounds of flour, how many pounds will 1-eighth of a dollar pay for? 4 4/5 How many pounds will a dollar pay for? 38 2/5

10. 24 is 5-eighths of what number? 38 2/5

11. Suppose 6 gallons of wine to leak from a cask in 8 ninths of an hour; how much will leak out in 1-ninth of an hour? 6/8 How many gallons in 1 hour? 6 6/8

12. 6 is 8-ninths of what number? 6 6/8

13. If 4-tenths of a yard of cloth be worth 33 cents, how much is 1 yard worth? 82 1/2

Direction. First find what 1-tenth of a yard is worth

14 If 3-eighths of a bale of cotton be worth 17 dollars, what is the whole bale worth? 45 1/3

15. A laborer spent 30 cents a day, and still saved 3-sevenths of his wages. How much was his wages? \$2.1/2.

16. Suppose that I have read 5-ninths of the pages in a certain book, and there are 35 pages more to be read; —how many pages are there in the book? 48 3/4.

NOTATION OF FRACTIONS.

Learners will now attend to the meaning of the words, FRACTION, DENOMINATOR, and NUMERATOR.

A *Fraction* is any part of *one*. For example, *one-half* of an orange is a *fraction* of 1 orange; *three-fourths* of an orange is another *fraction* of 1 orange.

In this book, fractions have been expressed by a number joined with a word; thus, 4-ninths. Fractions are commonly expressed by two numbers, standing one above the other, with a line between them; thus, $\frac{1}{2}$ one-half, $\frac{1}{3}$ one-third, $\frac{2}{3}$ two-thirds, $\frac{1}{6}$ one-sixth, $\frac{4}{5}$ four-fifths, $\frac{3}{9}$ three-ninths.

17. What fraction is expressed, when there is a 4 with a 1 over it? 7 with 2 over it? 8 with 5 over it? 10 with 6 over it?

18. Which is the greater fraction; $\frac{1}{2}$ or $\frac{1}{3}$? $\frac{1}{5}$ or $\frac{1}{3}$? $\frac{1}{7}$ or $\frac{1}{9}$? $\frac{1}{6}$ or $\frac{1}{10}$? $\frac{1}{4}$ or $\frac{1}{8}$?

19. Which is the greater fraction; $\frac{1}{4}$ or $\frac{2}{4}$? $\frac{6}{7}$ or $\frac{2}{7}$? $\frac{3}{5}$ or $\frac{1}{5}$? $\frac{4}{8}$ or $\frac{7}{8}$? $\frac{8}{10}$ or $\frac{3}{10}$?

The *Denominator* of a fraction, is the number of equal parts into which a *whole one* is divided. For example, if a whole orange be divided into 4 equal parts, the denominator is 4; the parts being denominated *fourths*.

The *Numerator* of a fraction is the number which shows how many of the equal parts the fraction expresses. For example, the fraction $\frac{3}{4}$ expresses 3 of the four equal parts; therefore 3 is the numerator.

20. What numerator, and what denominator, would express the fraction, four-fifths? two-eighths? six-ninths? one fifteenth? five-eighteenths?

When the numerator is equal to the denominator, thus, $\frac{4}{4}$, then the fraction is equal to 1; as 4-fourths of an orange, when joined together make 1 orange.

When the numerator is greater than the denominator, thus, $\frac{8}{4}$, then the fraction is equal to as many times 1 as the denominator is contained times in the numerator.

21. How many times 1, [how many whole ones], in $\frac{8}{4}$? in $\frac{12}{3}$? in $\frac{16}{2}$? in $\frac{20}{5}$? in $\frac{30}{10}$? in $\frac{24}{12}$?

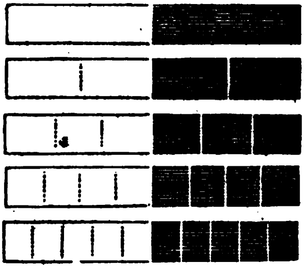
22. How many times 1, and what fraction over, in $\frac{7}{2}$? in $\frac{6}{5}$? in $\frac{8}{3}$? in $\frac{19}{4}$? in $\frac{36}{8}$? in $\frac{85}{10}$?

23. Where have you observed the numerator of a fraction to stand;—above, or below the denominator?

SECTION 25.

1. James has $\frac{1}{2}$ of a dollar, and Henry has $\frac{2}{4}$ of a dollar:—which of them has the most money?

Compare the fraction $\frac{1}{2}$ with other fractions.



2. $\frac{1}{2}$ is equal to how many fourths? 2

3. $\frac{1}{2}$ is equal to how many sixths? 3

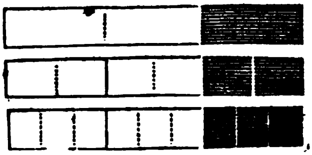
4. $\frac{1}{2}$ is equal to how many eighths? 4

5. $\frac{1}{2}$ is equal to how many tenths?

6. $\frac{1}{2}$ is equal to how many twelfths? how many sixteenths? 8 how many twentieths? 10

7. Edward broke a slate pencil into 3 equal pieces, and Albert broke one into 6 equal pieces. How many of Albert's pieces were equal to 1 of Edward's pieces?

Compare the fraction $\frac{1}{3}$ with other fractions.



8. $\frac{1}{3}$ is equal to how many sixths? 2

9. $\frac{1}{3}$ is equal to how many ninths? 3

10. $\frac{1}{3}$ is equal to how many twelfths? 4 how many eighteenths? 6 how many thirtieths? 10

Suggestion. $\frac{1}{3}$ of 1 is equal to $\frac{1}{3}$ of 12-twelfths.

11. $\frac{1}{4}$ is equal to how many eighths? 2 how many twelfths? 3 how many sixteenths? 4

12. $\frac{1}{5}$ is equal to how many tenths? 2 how many twentieths? 4 how many twenty-fifths? 5

13. $\frac{1}{6}$ is equal to how many twelfths? 2 how many eighteenths? 3 how many thirtieths? 10

14. $\frac{1}{7}$ is equal to how many fourteenths? 2 how many twenty-eighths? 4 how many thirty-fifths? 5

15. $\frac{3}{4}$ is equal to how many twentieths? 15

Solution. $\frac{1}{4}$ is equal to $\frac{5}{20}$, $\frac{3}{4}$ is equal to 3 times 5-twentieths, which is $\frac{15}{20}$.

16. $\frac{2}{3}$ is equal to how many twelfths? 8

17. A boy, who had $\frac{3}{5}$ of an orange, cut each fifth into 2 parts, (making *tenths*); his brother gave him $\frac{3}{10}$ more. What fraction of an orange had he at last? 6/10

18. Into how many parts must you cut a *sixth* of an orange, to make the parts *eighteenths*?..3.. Why?

19. $\frac{5}{6}$ is equal to how many eighteenths? 15

20. Change $\frac{4}{7}$ to fourteenths, and then add $\frac{5}{14}$ to it. 13/14

21. $\frac{7}{8}$ is equal to how many twenty-fourths? 21

22. Change $\frac{4}{9}$ to eighteenths, and then take $\frac{2}{18}$ from it. 8/16

SECTION 26.

1. What is meant by a *Fraction*?.——How is a fraction commonly expressed?.——What is the *Denominator* of a fraction?.——What is the *Numerator*?

2. If the denominator of a fraction be 9, and the numerator 7, how should these numbers be written?—and what would the fraction be called in reading it?

3. Suppose two fractions have numerators alike, and denominators different—which is the greater fraction—that with the greater, or the smaller denominator?

4. Suppose two fractions have denominators alike, and numerators different—which is the greater fraction—that with the greater, or the smaller numerator?

Observation. If an orange be cut into eighths, and then 4 of the eighths be joined together, these 4-*eighths* become 1-*half* of an orange. And thus the fraction, $\frac{4}{8}$, when reduced to its lowest terms, is $\frac{1}{2}$.

5. Reduce $\frac{2}{4}$ to its lowest terms—that is, find the lowest numerator and denominator, that will express a quantity equal to $\frac{2}{4}$. 1/2

6. Reduce $\frac{3}{6}$ to its lowest terms. 1/2

7. Reduce $\frac{2}{6}$ to its lowest terms. 1/3 Reduce $\frac{4}{6}$. 2/3

8. Reduce $\frac{2}{8}$ to its lowest terms. 1/4 Reduce $\frac{6}{8}$. 3/4

9. Reduce $\frac{3}{9}$ to its lowest terms. 1/3 Reduce $\frac{6}{9}$. 2/3

Observation. A fraction is reduced, by dividing the numerator and denominator by any number, which will divide them both without a remainder. For example, we reduce $\frac{6}{10}$ thus; 2 in 6, 3 times, 3 is a new numerator: 2 in 10, 5 times, 5 is a new denominator.

10. Reduce each of the following fractions to its lowest terms. $\frac{5}{10}$. $\frac{4}{10}$. $\frac{8}{10}$. $\frac{6}{12}$. $\frac{4}{12}$. $\frac{8}{12}$. $\frac{2}{12}$. $\frac{10}{15}$.

11. Stephen's knife cost $\frac{3}{12}$ of a dollar, and John's cost $\frac{5}{20}$ of a dollar. Whose knife cost the most? ——

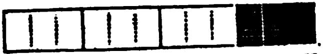
12. Reduce the fractions, $\frac{9}{12}$ and $\frac{10}{40}$ to their lowest terms, and then add them together.

13. Reduce, and then add together, $\frac{16}{20}$ and $\frac{12}{15}$.

14. Reduce, and then add together, $\frac{36}{45}$ and $\frac{4}{20}$.

SECTION 27.

1. $\frac{1}{4}$ of a water melon was divided equally among 3 boys. What part of the whole melon did 1 boy receive?



2. $\frac{1}{3}$ of $\frac{1}{4}$ is equal to what part of 1?

Solution. If $\frac{1}{4}$ be divided into 3 equal parts, it will take 12 such parts to make a whole one. Therefore, $\frac{1}{3}$ of $\frac{1}{4}$ is $\frac{1}{12}$. [$_3$ times $_4$ is $_{12}$.]

3. What part of a whole one is $\frac{1}{6}$ of $\frac{1}{5}$?

Illustration. If $\frac{1}{5}$ of an orange were cut into 6 equal parts, it would take 5 times 6 such parts to make a whole orange. *Operation.* $_6$ times $_5$ is $_{30}$.

4 What part of 1 is $\frac{1}{2}$ of $\frac{1}{2}$? $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{4}$? $\frac{1}{3}$ of $\frac{1}{5}$? $\frac{1}{4}$ of $\frac{1}{6}$? $\frac{1}{8}$ of $\frac{1}{7}$?

5. If $18\frac{1}{4}$ dollars [18 and $\frac{1}{4}$ dollars] be divided equally among 3 men, what will each man receive?

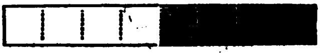
6. What is $\frac{1}{3}$ of $18\frac{1}{4}$?

Sol. $\frac{1}{3}$ of 18 is 6; $\frac{1}{3}$ of $\frac{1}{4}$ is $\frac{1}{12}$; 6 plus $\frac{1}{12}$ is $6\frac{1}{12}$.

7. What is $\frac{1}{5}$ of $30\frac{1}{2}$? $\frac{1}{6}$ of $24\frac{1}{8}$? $\frac{1}{9}$ of $18\frac{1}{4}$?

8. A boy, having $\frac{1}{2}$ of a dollar, paid $\frac{3}{4}$ of his money for a knife. What part of a dollar did he pay?

9. $\frac{3}{4}$ of $\frac{1}{2}$ is equal to what part of 1?

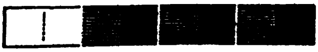


Solution. *One*-fourth of $\frac{1}{2}$ is equal to $\frac{1}{8}$; *three*-fourths of $\frac{1}{2}$ is equal 3 times $\frac{1}{8}$, which is $\frac{3}{8}$.

10. What part of 1 is $\frac{2}{3}$ of $\frac{1}{2}$? $\frac{3}{4}$ of $\frac{1}{3}$? $\frac{4}{5}$ of $\frac{1}{8}$? $\frac{2}{6}$ of $\frac{1}{9}$? $\frac{5}{7}$ of $\frac{1}{8}$? $\frac{6}{8}$ of $\frac{1}{10}$?

11. A girl having $\frac{3}{4}$ of a dollar, paid $\frac{1}{2}$ of her money for a book. What part of a dollar did she pay?

12. $\frac{1}{2}$ of $\frac{3}{4}$ is equal to what part of 1?



Solution. $\frac{1}{2}$ of *one*-fourth [$_2$ times $_4$ is $_8$] is equal to $\frac{1}{8}$; $\frac{1}{2}$ of $\frac{3}{4}$ is 3 times $\frac{1}{8}$, which is $\frac{3}{8}$.

13. Which is the greater fraction of a dollar,—$\frac{3}{4}$ of $\frac{1}{2}$ of a dollar,—or, $\frac{1}{2}$ of $\frac{3}{4}$ of a dollar?

14. What part of 1 is $\frac{1}{2}$ of $\frac{2}{4}$? $\frac{1}{3}$ of $\frac{2}{3}$? $\frac{1}{3}$ of $\frac{4}{5}$? $\frac{1}{4}$ of $\frac{3}{4}$? $\frac{1}{5}$ of $\frac{5}{9}$? $\frac{1}{8}$ of $\frac{7}{10}$?

15. If 4 cloaks are to be made from $12\frac{3}{8}$ yards of cloth, how many yards must be put into each cloak?

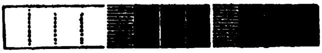
16. What is $\frac{1}{4}$ of $12\frac{3}{8}$?

Solution. $\frac{1}{4}$ of 12 is 3: $\frac{1}{4}$ of $\frac{1}{8}$ is $\frac{1}{32}$, $\frac{1}{4}$ of $\frac{3}{8}$ is $\frac{3}{32}$: then 3 plus $\frac{3}{32}$ is $3\frac{3}{32}$.

17. What is $\frac{1}{5}$ of $20\frac{2}{3}$? $\frac{1}{7}$ of $28\frac{4}{9}$? $\frac{1}{9}$ of $45\frac{7}{8}$?

18. A boy having $\frac{2}{3}$ of a dollar, paid $\frac{3}{4}$ of his money for a book. What part of a dollar did he pay?

19. $\frac{3}{4}$ of $\frac{2}{3}$ is equal to what part of 1?



Solution. $\frac{1}{4}$ of $\frac{1}{3}$ is equal to $\frac{1}{12}$; $\frac{3}{4}$ of $\frac{1}{3}$ is $\frac{3}{12}$; $\frac{3}{4}$ of $\frac{2}{3}$ is 2 times $\frac{3}{12}$, or $\frac{6}{12}$. $\frac{6}{12}$ is equal to $\frac{1}{2}$.

20. $\frac{2}{3}$ of an acre of land was divided into 5 equal lots, and a gardener bought 3 of the lots. What part of an acre did he buy?

Direction. First find what part of an acre there was in one lot;—then, what part in 3 lots.

21. What part of 1 is $\frac{3}{5}$ of $\frac{2}{3}$?

Direction. First find what part of a whole one $\frac{1}{5}$ of $\frac{1}{3}$ is;—then find $\frac{1}{5}$ of $\frac{2}{3}$,—and then $\frac{3}{5}$ of $\frac{2}{3}$.

22. What part of 1 is $\frac{2}{3}$ of $\frac{2}{5}$? $\frac{3}{4}$ of $\frac{3}{4}$? $\frac{4}{5}$ of $\frac{3}{4}$? $\frac{2}{3}$ of $\frac{2}{3}$? $\frac{3}{5}$ of $\frac{2}{4}$? $\frac{3}{4}$ of $\frac{5}{6}$?

23. A merchant, who owned $\frac{5}{8}$ of a ship, sold $\frac{4}{7}$ of his share. What part of the ship did he sell?

24. What part of 1 is $\frac{4}{7}$ of $\frac{5}{8}$? $\frac{2}{6}$ of $\frac{3}{9}$? $\frac{7}{8}$ of $\frac{2}{3}$? $\frac{4}{6}$ of $\frac{5}{7}$? $\frac{6}{8}$ of $\frac{6}{8}$? $\frac{4}{5}$ of $\frac{9}{10}$?

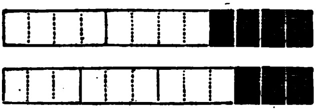
25. Suppose a piece of broad-cloth to contain $32\frac{3}{4}$ yards;—how many yards are there in $\frac{5}{8}$ of the piece?

Direction. First find $\frac{5}{8}$ of 32; then find $\frac{5}{8}$ of $\frac{3}{4}$.

26. What is $\frac{2}{5}$ of $20\frac{2}{4}$? $\frac{3}{9}$ of $36\frac{5}{9}$? $\frac{4}{10}$ of $40\frac{3}{7}$? $\frac{6}{7}$ of $35\frac{6}{7}$? $\frac{6}{9}$ of $54\frac{7}{8}$? $\frac{7}{10}$ of $50\frac{2}{9}$?

SECTION 28.

1. Suppose you have $\frac{1}{3}$ of an orange and $\frac{1}{4}$ of an orange,—into how many parts must you cut the *third*, and into how many parts the *fourth*, so that the parts of the third, and of the fourth shall be of equal size?



We here see, that when $\frac{1}{3}$ is divided into 4 parts, and $\frac{1}{4}$ into 3 parts, the parts are all *twelfths*.

In this example 12 is found to be a *Common Denominator;* and the two fractions $\frac{1}{3}$ and $\frac{1}{4}$, become $\frac{4}{12}$ and $\frac{3}{12}$.

2. Change $\frac{1}{2}$ and $\frac{1}{3}$ to a common denominator: that is, find how many parts a *half*, and how many a *third* must be divided into, so that the parts shall be equal: also find how many of these parts would make a whole one.

Observation. If two denominators be multiplied together they will produce a common denominator.

3. Change $\frac{1}{3}$ and $\frac{1}{5}$ to a common denominator.

Solution. 3 times 5 is 15, the common denominator $\frac{1}{3}$ of $\frac{15}{15}$ is $\frac{5}{15}$; $\frac{1}{5}$ of $\frac{15}{15}$ is $\frac{3}{15}$. *Answer.* $\frac{5}{15}$ and $\frac{3}{15}$.

4. Change $\frac{1}{4}$ and $\frac{1}{2}$ to a common denominator.

5 Change $\frac{1}{3}$ and $\frac{1}{6}$ to a common denominator.

6 Change $\frac{1}{4}$ and $\frac{1}{5}$ to a common denominator.

7. Change $\frac{1}{6}$ and $\frac{1}{4}$ to a common denominator.

8. Change $\frac{1}{3}$ and $\frac{1}{8}$ to a common denominator.

9. Change $\frac{1}{3}$ and $\frac{1}{4}$ and $\frac{1}{6}$ to twelfths.

10. Change $\frac{1}{4}$ and $\frac{1}{6}$ and $\frac{1}{8}$ to twenty-fourths.

11. Change $\frac{1}{5}$ and $\frac{1}{10}$ and $\frac{1}{15}$ to thirtieths.

12. Change $\frac{1}{4}$ and $\frac{3}{5}$ to a common denominator.

Solution. 4 times 5 is 20, the common denominator $\frac{1}{4}$ of $\frac{20}{20}$ is $\frac{5}{20}$; $\frac{1}{5}$ of $\frac{20}{20}$ is $\frac{4}{20}$, $\frac{3}{5}$ is 3 times $\frac{4}{20}$, $\frac{12}{20}$.

13. Change $\frac{1}{6}$ and $\frac{3}{4}$ to a common denominator.

14. Change $\frac{2}{3}$ and $\frac{1}{5}$ to a common denominator.

15. Change $\frac{5}{6}$ and $\frac{1}{5}$ to a common denominator.

16. Change $\frac{1}{2}$ and $\frac{4}{7}$ to a common denominator

17. Change $\frac{2}{3}$ and $\frac{3}{4}$ to a common denominator.

18. Change $\frac{3}{5}$ and $\frac{6}{7}$ to a common denominator.

19. Change $\frac{7}{9}$ and $\frac{5}{6}$ to a common denominator.

20. Change $\frac{8}{9}$ and $\frac{7}{8}$ to a common denominator.

21. How much is $\frac{2}{4}$ and $\frac{3}{7}$ added together.

Solution. $\frac{1}{4}$ is equal to $\frac{7}{28}$, and $\frac{2}{4}$ is $\frac{14}{28}$: $\frac{1}{7}$ is equal to $\frac{4}{28}$ and $\frac{3}{7}$ is $\frac{12}{28}$. $\frac{14}{28}$ plus $\frac{12}{28}$ is $\frac{26}{28}$, equal to $\frac{13}{14}$.

22. How much is $\frac{1}{3}$ and $\frac{4}{9}$ added together?

23. How much is $\frac{3}{8}$ and $\frac{2}{7}$ added together?

24. How much is $\frac{2}{6}$ and $\frac{3}{5}$ added together?

25. How much is $\frac{3}{7}$ and $\frac{2}{9}$ added together?

26. How much is $\frac{2}{3}$ and $\frac{3}{4}$ added together?

27. $\frac{1}{3}$ and $\frac{1}{4}$ and $\frac{5}{12}$ are how many twelfths?

28. $\frac{2}{3}$ and $\frac{1}{6}$ and $\frac{1}{12}$ are how many twelfths?

29. $\frac{1}{4}$ and $\frac{1}{8}$ and $\frac{5}{16}$ are how many sixteenths?

30. If $\frac{4}{7}$ be taken from $\frac{3}{5}$, how much will remain

Solution. [$_7$ times $_5$ is $_{35}$]. $\frac{1}{7}$ is equal to $\frac{5}{35}$, $\frac{4}{7}$ is $\frac{20}{35}$ $\frac{1}{5}$ is equal to $\frac{7}{35}$, $\frac{3}{5}$ is $\frac{21}{35}$ Then $\frac{21}{35}$ minus $\frac{20}{35}$ is $\frac{1}{35}$.

33. Take $\frac{2}{3}$ from $\frac{3}{4}$,—how much remains?
34. Take $\frac{3}{5}$ from $\frac{7}{8}$,—how much remains?
35. Take $\frac{4}{7}$ from $\frac{5}{6}$,—how much remains?
36. Take $\frac{1}{2}$ from $\frac{8}{9}$,—how much remains?
37. Take $\frac{3}{8}$ from $\frac{1}{2}$,—how much remains?

Section 29.

1. A farmer gathered 21$\frac{2}{3}$ bushels of apples from one tree, and 10$\frac{3}{8}$ from another. How many bushels did he gather from both trees?

Direction. First add together the whole bushels, then change the fractions of a bushel to a common denominator and add the new numerators.

2. If a bonnet cost 5$\frac{3}{4}$ dollars and a shawl 5$\frac{7}{10}$ dollars, how much do they both cost?

3. On a certain day, I travelled 30$\frac{5}{6}$ miles in a stage, 15$\frac{4}{7}$ miles in a gig, and 10 miles on horseback. How many miles did I travel that day?

4. A farmer sold a cow for 23$\frac{7}{8}$ dollars, and a calf for 4$\frac{4}{5}$ dollars. How much did he get for both?

5. Three soldiers shared a loaf of bread as follows:—the first man took $\frac{2}{7}$ of it, the second took $\frac{1}{4}$ of it, and the third took the remainder. What part of the loaf did the third soldier get?

6. Three men, A, B, and C, are to reap a field of wheat—A is to reap $\frac{3}{8}$ of it, B $\frac{4}{10}$ of it, and C the remainder. What part of the field is C to reap?

7. A trader, having 2 barrels of flour, sold $\frac{3}{4}$ of a barrel to one man, and $\frac{2}{3}$ of a barrel to another man. What part of a barrel had he remaining?

8. A man, having 10 dollars, paid away 4$\frac{1}{4}$ dollars for a hat, and 3$\frac{1}{5}$ dollars for a pair of boots. How many dollars had he left?

9. A miller, having 20 bushels of corn, sold 6$\frac{2}{3}$ bushels to one man, and 9$\frac{4}{5}$ to another. How many bushels had he remaining?

10. A man paid 25$\frac{6}{8}$ dollars for a watch, and 2$\frac{3}{10}$ dollars for having it repaired, and then sold it so as to gain 3 dollars. For how much did he sell it?

SECTION 30.

1. Suppose I had 4 oranges,—to how many boys could I give $\frac{2}{3}$ of an orange apiece?

Direction. Find how many thirds of 1 orange in 4 oranges, then find how many times 2-thirds there are.

2. How many times is $\frac{2}{3}$ contained in 4?

Solution. 1 is equal to $\frac{3}{3}$, and 4 is equal to 4 tim $\frac{3}{3}$ or $\frac{12}{3}$: then $\frac{2}{3}$ is contained in $\frac{12}{3}$, 6 times.

3. How many pairs of gloves can I buy for 6 dollars, the price being $\frac{3}{4}$ of a dollar a pair?

4. How many times is $\frac{3}{4}$ contained in 6?

5. Suppose a man to walk 1 mile in $\frac{2}{9}$ of an hour,—what distance will he walk in 1 hour?

6. How many times is $\frac{2}{9}$ contained in 1?

Solution. 1 is equal to $\frac{9}{9}$. $\frac{2}{9}$ in $\frac{9}{9}$, $4\frac{1}{2}$ times.

7. How many yards of cloth, that is sold for $\frac{3}{8}$ of a dollar a yard, can be bought for 4 dollars?

8. How many times is $\frac{3}{8}$ contained in 4?

9. How many pounds of tea, that is sold for $\frac{5}{6}$ of a dollar a pound, can be bought for $4\frac{1}{6}$ dollars?

10. How many times is $\frac{5}{6}$ contained in $4\frac{1}{6}$?

11. If $\frac{4}{7}$ of a barrel of biscuit will last a ship's crew 1 week, how many weeks will $3\frac{5}{7}$ barrels last them?

12. How many times is $\frac{4}{7}$ contained in $3\frac{5}{7}$?

13. How many yards of cloth, at $\frac{1}{3}$ of a dollar per yard, can be bought for $\frac{4}{5}$ of a dollar?

Solution. $\frac{1}{3}$ of a dollar is equal to $\frac{5}{15}$ of a dollar; $\frac{4}{5}$ of a dollar is equal to $\frac{12}{15}$ of a dollar. As many yards can be bought as $\frac{5}{15}$ is contained times in $\frac{12}{15}$.

14. How many times is $\frac{1}{3}$ contained in $\frac{4}{5}$?

15. If a man can hoe $\frac{1}{3}$ of a field of corn in 1 day, in how many days can he hoe $\frac{3}{4}$ of the field?

16. How many times is $\frac{1}{3}$ contained in $\frac{3}{4}$?

17. How many times is $\frac{2}{5}$ contained in $\frac{6}{7}$?

Direction. Change both fractions to a common denominator; then divide one numerator by the other.

18. How many times is $\frac{3}{4}$ contained in $\frac{5}{6}$?

19 How many times is $\frac{2}{9}$ contained in $\frac{1}{2}$?

20 How many times is $\frac{4}{5}$ contained in $\frac{9}{10}$?

21. Suppose that 6 cloaks are to be made from $22\frac{3}{4}$ yards of broad-cloth;— what number of yards must be put into each cloak?

Solution. Each cloak must contain $\frac{1}{6}$ of $22\frac{3}{4}$ yards. $\frac{1}{6}$ of $22\frac{3}{4}$ is 3, there being $4\frac{3}{4}$ over. $4\frac{3}{4}$ is equal to $\frac{19}{4}$. $\frac{1}{6}$ of $\frac{1}{4}$ is $\frac{1}{24}$, and $\frac{1}{6}$ of $\frac{19}{4}$ is 19 times as much, or $\frac{19}{24}$. Then 3 yards plus $\frac{19}{24}$ of a yard, are $3\frac{19}{24}$ yards.

22. If $30\frac{2}{5}$ pounds of bread will supply a family for 1 week, how many pounds will supply the family for 1 day?

23. What is $\frac{1}{7}$ of $30\frac{2}{5}$?

24. If 8 yards of cloth cost $51\frac{3}{5}$ dollars, what will 1 yard cost? What will 3 yards cost?

25. What is $\frac{1}{8}$ of $51\frac{3}{5}$? What is $\frac{3}{8}$ of $51\frac{3}{5}$?

SECTION 31.

Note to Teachers. This section furnishes a test of the learner's knowledge of the several operations taught since the *Review* in Section 12. Should the learner fail in any of these examples, he must be put back to the section, whose number is prefixed to the example in which the failure appears.

REVIEW.

1. (§ 13.) How many hours will it take you to read a book of 75 pages, if you read 9 pages an hour?

2. (§ 14.) If a bushel of oats be given in exchange for $\frac{1}{8}$ of a bushel of grass seed, how many bushels of oats must be given for $6\frac{5}{8}$ bushels of grass seed?

3. (§ 15.) If a man drink $\frac{1}{4}$ of a gallon of beer in a day, how many gallons will he drink in 33 days?

4. (§ 16.) Suppose a watch to cost $17\frac{6}{8}$ dollars, and a chain $1\frac{3}{8}$ dollars,— what is the cost of both?

5. (§ 17.) If 1 quire of letter paper cost $\frac{3}{10}$ of a dollar, what will 7 quires cost, at the same rate?

6. (§ 18.) Suppose a fire engine to throw from its pipe, $4\frac{5}{6}$ barrels of water in 1 minute,— what number of barrels will it throw in 10 minutes?

7. (§ 19.) A farmer sold $\frac{1}{4}$ of a ton of hay for $3\frac{7}{8}$ dollars. What is the price of a ton at the same rate?

8. (§ 20.) There were 9 men, who performed a piece of work, for which they received 6 bushels of wheat. What part of a bushel was the share of each man?

9. (§ 21.) A ship's crew used 14 casks of water, ring a passage of 5 months, from Calcutta to New York How much did that quantity allow them per month?

10. (§ 22.) If 7 barrels of flour cost 30 dollars, what will 9 barrels cost at the same rate?

11. (§ 23.) A man purchased a farm, containing 98 acres; but not being able to pay for the whole, he sold off $\frac{3}{10}$ of the land. How many acres did he sell?

12. (§ 24.) If a mill grind 9 bushels of corn in $\frac{4}{7}$ of an hour, how many bushels will it grind in 1 hour?

13. (§ 25.) If pen-knives are worth $\frac{1}{4}$ of a dollar apiece, and pencils $\frac{1}{20}$ of a dollar apiece, how many pencils must be given in exchange for 3 knives?

14. (§ 26.) Reduce $\frac{16}{24}$ to its lowest terms. How do you reduce a fraction to its lowest terms?

15. (§ 27.) A man, owning $\frac{3}{4}$ of an acre of land, sold $\frac{2}{5}$ of what he owned. What part of an acre did he sell?

16. (§ 28.) Change $\frac{5}{6}$ and $\frac{3}{8}$ to a common denominator. How do you change fractions to a com. denom.?

17. (§ 28.) John gave $\frac{1}{3}$ of a dollar for a book, and $\frac{1}{4}$ of a dollar for a slate, and then sold them both for $\frac{3}{5}$ of a dollar. Did he gain or lose?—How much?

18. (§ 29.) A farmer cut $18\frac{3}{8}$ tons of hay, and sold $2\frac{2}{9}$ tons of it. How many tons had he left?

19. (§ 30.) When coffee is $\frac{2}{9}$ of a dollar per pound, how many pounds can be bought for $\frac{5}{6}$ of a dollar?

20. (§ 30.) A tenant raised $58\frac{3}{5}$ bushels of corn, and gave his landlord $\frac{4}{9}$ of it for the use of the land. How many bushels had the tenant for himself?

SECTION 32.

MISCELLANEOUS EXAMPLES.

1. The Gulf Stream is a current in the ocean, running 3 miles an hour. If a steam boat, whose engine propels her $12\frac{1}{2}$ miles an hour, should run in the stream, *with* the current, what distance would it move in 8 hours?

2. If the above steam boat were running *against* the current, what distance would it move in 8 hours?

3. A trader bougnt 25 barrels of flour, paying 7 dollars a barrel for 11 barrels of it, and 9 dollars a barrel for the remainder. What did the whole cost?

4. What sum of money must be divided among 10 men, so that each man shall receive 19$\frac{1}{4}$ dollars?

5. Suppose a man can perform a journey in 8 days, travelling 10 hours a day,—in how many days can he perform it, travelling 12 hours a day?

6. Henry reads 12 pages in the same time that William is reading 7 pages;—how many pages will Henry read while William is reading 60?

7. If 72 dollars be divided equally among 9 sailors, how many weeks' board, at 3 dollars a week, will each sailor's share pay for?

8. A man failed in trade, and could pay only 4 dollars on every 9 dollars that he owed. How much did he pay on a debt of 100 dollars?

9. There is a pole standing in a pond, so that $\frac{4}{5}$ of it is under the water, and 3$\frac{1}{2}$ feet of it is above the water. How long is the pole?

10. A pole is standing so that $\frac{1}{8}$ of it is in the mud, $\frac{3}{4}$ of it is in the water, and 2$\frac{1}{2}$ feet of it is above the water. What is the length of this pole?

11. If A borrow of B, 8 bushels of wheat, when the price is 9 shillings a bushel; how much wheat must A return, when the price is 7 shillings a bushel?

12. A trader, having 100 dollars, laid out $\frac{7}{10}$ of his money for narrow-cloth at 5 dollars a yard, and the remainder for broad-cloth at 7 dollars a yard. How many yards did he buy of each sort?

13. If 2$\frac{1}{2}$ bushels of apples will fill a barrel, how many bushels will it take to fill 8 barrels?

14. John can pick a quart of berries in an hour; Ann can pick twice as fast;—how many can both pick in an hour? In what time would they pick 10 quarts?

15. How many bushels of corn must a miller grind, to get 1 bushel for himself—allowing, that he takes 2 quarts from every bushel before grinding it, and, that 32 quarts make a bushel?

Suggestion. He gets 2 qts. for grinding less than a bush.

16. If 1 monitor can mend 2 pens in a minute, how long will it take 3 monitors to mend 28 pens?

17. It is worth as much to pasture 1 cow, as 5 sheep. If I pay 1 dollar a month for pasturing a cow, what must I pay for pasturing 35 sheep, 7 months?

18. If 3 horses eat 1 ton of hay in 1 month, how long will 5 tons last 4 horses?

19. A drover sold a cow for 20 dollars, and, in so doing, he gained a sum equal to $\frac{1}{3}$ of what he had paid for the cow. How much had he paid for her?

20. Suppose a man can dig a trench in 4 days, and a boy in 6 days;—what part of it can each dig in 1 day? What part of it can both together dig in 1 day? In what time can they both finish it?

21. Suppose a cistern has one tap that will discharge it in 5 hours, and another in 7 hours,—in what time will they both discharge it?

22. If 1 man can perform a piece of work in 35 days, in what time can 6 men perform it?

23. If 4 men drink a barrel of cider in 20 days, in what time will 9 men drink the same quantity?

24. If 9 men can do a piece of work in 5 days, in how many days will 7 men do the same work?

25. A farmer kept his sheep in four pastures—In the first pasture he had $\frac{3}{10}$ of his flock; in the second, $\frac{2}{10}$; in the third, $\frac{1}{10}$; and in the fourth he had 32 sheep. How many sheep had he?

26. There is a school, in which $\frac{1}{4}$ of the scholars read in the *Classical Reader*, $\frac{1}{3}$ read in the *National Reader*, $\frac{1}{6}$ read in *Pierpont's Introduction*, and 36 little boys read in the *Young Reader*. How many scholars are there in the school?

27. If a post 4 feet high cast a shadow 3 feet, at noonday, what is the height of a steeple, that casts a shadow 90 feet, at the same time.

28. A and B are laborers—A earns 10 dollars a month, and B 9; but A gives $\frac{1}{6}$ of his earnings to B. What will each lay up in 3 months?

29. If 12 men can perform a piece of work in 6 days, in what time would 10 men perform the work?

30. How many men must be employed, to dig a trench in 3 days, that 6 men can dig in 4 days?

31. Suppose 2 men start from the same place, and travel in opposite directions, one at the rate of 5 miles an hour and the other ⅔ as fast;—how far apart will they be in 11 hours?

32. A fox has 35 rods the start of a greyhound, but the hound runs 10 rods while the fox runs 7. How many rods must the hound run to catch the fox?

33. A started on a journey, and travelled 5 miles an hour—B started on the same journey, 2 hours after, and travelled 7½ miles an hour. In how many hours did B overtake A?

34. A jockey paid 9 times as much for his horse as he did for his saddle; he paid 3 times as much for his saddle as he did for his bridle; and for his bridle he paid 6 dollars. What did the whole cost?

35. Suppose a man can reap ⅓ of a field of wheat in a day, and his son can reap ¼ of it in a day;—what part of it can they both reap in a day? In what time can they both reap the whole?

36. A boy being asked how much money he had, replied—'If I had as much more, and ½ as much more, and ¼ as much more as I really have, I should then have 70 cents.' How much must he have had?

37. A gentleman paid 85 dollars for 5 weeks' board of himself, his son, and one servant, at a hotel—His own board cost twice as much as his son's, and his son's cost three times as much as the servant's. What was the expense of each, per week?

NOTE TO TEACHERS.

The teacher should now be provided with "A KEY TO THE NORTH AMERICAN ARITHMETIC," otherwise he must lose much time in examining operations. The KEY is a small book designed exclusively for teachers, and contains answers to all the examples in the Written Arithmetic. If the KEY cannot be obtained at *every* place where the Arithmetic is for sale, it may still be obtained from the publishers of the Arithmetic, and from the principal book-stores in the larger cities and towns.

A variety of expedient methods may be pursued, in examining written operations in arithmetic; and perhaps no one system can be adopted, from which it will not be found advantageous, occasionally, to depart. My own practice for several years, with occasional variation, has been as follows.

A certain number of examples having been assigned for a lesson the day previous, each scholar is supposed to be prepared with the solutions upon his slate, and the class are paraded for recitation. Every scholar passes his slate into the hands of the scholar next above him, except the head scholar, who hands his to the foot scholar. The first scholar then reads from the slate he holds, the answer to the first example; and the teacher, holding the key, declares the answer to be *right*, or *wrong*. When the answer has been pronounced *right*, it is the duty of every scholar who finds a different answer upon the slate he holds, to signify it, and the error is noted against the owner of the slate. The first example being disposed of, the answer to the second example is read by the second scholar, and disposed of in like manner. Thus the reading of answers goes through the class, and each scholar detects the errors of his neighbour. Individual scholars are occasionally called upon to explain their work in a particular example, and to give their reasons for the operation adopted. By this mode of examination, the work of a large class is particularly inspected, in nearly the same time that would be required to inspect the work of one scholar. Besides the advantage of despatch in this mode of examination, the exercise itself is beneficial to the pupils.—Each scholar acts the part of an inspector—he is interested to be critical—he acquires a facility in deciphering the work of others—and thus his perceptive powers are cultivated, and a habit of alertness is attained.

Before the learners attempt to perform operations by figures, they should be able to write figures with facility, and to arrange them regularly. To attain this object, the arrangement of figures below, may be repeatedly copied upon the slate, until a good degree of despatch and accuracy is acquired.

1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
7 8 9 0 1 2	7 8 9 0 1 2	7 8 9 0 1 2
3 4 5 6 7 8	3 4 5 6 7 8	3 4 5 6 7 8
9 0 1 2 3 4	9 0 1 2 3 4	9 0 1 2 3 4
5 6 7 8 9 0	5 6 7 8 9 0	5 6 7 8 9 0
1 2 3 4 5 6	1 2 3 4 5 6	1 2 3 4 5 6
7 8 9 0 1 2	7 8 9 0 1 2	7 8 9 0 1 2
3 4 5 6 7 8	3 4 5 6 7 8	3 4 5 6 7 8

WRITTEN ARITHMETIC.

CHAPTER I.

NUMERATION.

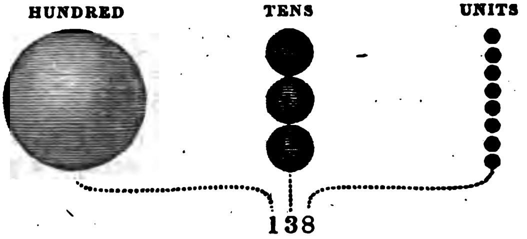
SECTION 1.

THE UNIT, which is the first thing to be considered in numeration, signifies *One*. The figure 1 stands for one unit; 2, for two units; 3, for three units; 4, for four units; 5, for five units; 6, for six units; 7, for seven units; 8, for eight units; 9, for nine units.

The **TEN** is a number which is made up of ten units. One ten is expressed thus, 10; two tens, thus, 20; three tens, thus, 30; four tens, thus, 40; &c.

The **HUNDRED** is a number which is made up of ten tens. One hundred is expressed thus, 100; two hundreds, thus, 200; three hundreds, thus, 300; &c.

Suppose the balls below, which are arranged in three places, to represent 8 units, 3 tens, and 1 hundred.



Learn from the figures above, that the first or right hand figure expresses units, the second figure expresses tens, and the third figure expresses hundreds.

The THOUSAND is a number, which is made up of ten hundreds. One thousand is expressed thus, 1000; two thousand, thus, 2000; three thousand, thus, 3000; &c. Observe, that a figure expresses thousands, when it stands in the fourth place from the right; therefore ten thousand is expressed thus, 10000; and a hundred thousand, thus, 100000.

Examine the following *Numeration Table.* Begin at the right hand, and observe, that every three figures may be viewed by themselves;—the first three express so many *units, tens and hundreds;* the second three, so many *Thousands;* the third three, so many *Millions;* the fourth three, *Billions;* the fifth three, *Trillions.**

Hundreds of trillions	Tens of trillions	TRILLIONS	Hundreds of billions	Tens of billions	BILLIONS	Hundreds of millions	Tens of millions	MILLIONS	Hundreds of thousands	Tens of thousands	THOUSANDS	Hundreds	Tens	UNITS
4	7	2	1	5	6	7	9	5	8	4	1	5	2	6

To read the line of figures in this table, begin with the left hand figure, and proceed as follows.

Four hundred	seventy-	two *Trillion,*	one hundred	fifty-	six *Billion,*	seven hundred	ninety-	five *Million,*	eight hundred	forty-	one *Thousand,*	five hundred	twenty-	six.
4	7	2	1	5	6	7	9	5	8	4	1	5	2	6

This character, 0, called *nought,* or *cipher,* expresses nothing of itself—it stands only to occupy a place, where there is none of the denomination belonging to that place to be expressed. For example, in the number 240, there are no units; therefore a cipher stands in the units' place. In the number 407, there are no tens; therefore a cipher stands in the tens' place.

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* The old method of embracing six figures in a period, is of late abandoned.

Note to Teachers. Require the learners to copy upon their slates the following figures expressing numbers. Then require them to read from their slates the several numbers expressed.

(Ex 1.)	508	(19)	1 000 001
(2)	3 861	(20)	90 040
(3)	1 050	(21)	107 090
(4)	27 400	(22)	6 000 304
(5)	13 008	(23)	77 010 000
(6)	29 111	(24)	100 100 011
(7)	112 600	(25)	220 002
(8)	30 030	(26)	11 333 111
(9)	206 209	(27)	216 090 900
(10)	500 088	(28)	10 000 004
(11)	7 432 040	(29)	8 000 000 500
(12)	200 005	(30)	50 000 000 036
(13)	9 070 638	(31)	1 000 700 007
(14)	3 018 103	(32)	8 400 052 000 600
(15)	16 974 036	(33)	8 631 008 000
(16)	340 007 140	(34)	22 000 004
(17)	31 031 032	(35)	919 000 000 060
(18)	9 908 000	(36)	86 000 001 100 018

SECTION 2.

Note to Teachers. The following numbers written in words, are to be written upon the slate in figures. If the learner meet with difficulty in denoting the larger numbers, he may be instructed to repeat the Numeration Table, from units up to the highest denomination in the number to be denoted; and, while repeating the table, he may make a dot for each denomination, arranging the whole in a line. Then, the figure to express the highest denomination may be written under the left hand dot, and there will be no difficulty in arranging the figures of other denominations under their respective dots.

1. Seventy.
2. Forty-eight.
3. One hundred and twenty-four.
4. Six hundred and nine.
5. Three thousand, and six hundred.
6. Two thousand, four hundred and fifty.
7. Nineteen thousand, and sixty-eight.
8. Five thousand, seven hundred and thirty-one

9. Thirty-six thousand, seven hundred and forty
10. Two hundred and sixty-eight thousand.
11. Nine hundred five thousand, and one hundred.
12. Eighteen thousand, seven hundred and thirty-five.
13. Seven hundred thousand and nine.
14. Thirteen million, sixteen thousand, and nineteen
15. One hundred five million, two thousand, and one
16. Six billion, forty million, and six thousand.
17. Twenty-one billion, and one hundred million.

18. Five trillion, fourteen billion, seventy million, one thousand, two hundred and thirty-six.

19. One hundred twenty-two trillion, eight hundred and forty-seven thousand.

20. Ten billion, nine hundred eighty-seven thousand, seven hundred and thirty.

21. Seven hundred trillion, and thirty-six thousand.

22. Twelve billion, eight hundred forty-two thousand, seven hundred and eighty.

23. Twenty-nine trillion, eight hundred nine billion, one thousand, and eighteen.

24. Eight hundred twenty-three billion, ten million, eight thousand, and fifteen.

Questions to be answered Orally.

(1) What is a *unit?* (2) What is the greatest number, that can be expressed by one figure alone? (3) In what situation must the figure 9 stand, to express 9 tens? (4) What is the greatest number that can be expressed by two figures? (5) Recite the several denominations of numbers, from *units* to *trillions*, as they stand in the Numeration Table. (6) What denominations are expressed in the 1st. three places of figures? (7) What denominations are expressed in the 2nd. three places? (8) Where must the figure 7 stand to express 7 tens of thousands—that is, seventy thousand? (9) What denominations are expressed in the 3rd. three places? (10) Where must the figure 2 stand, to express two hundred thousand?

CHAP. II.

ADDITION.

SECTION 1.

1. What is the whole sum of 6312 dollars, 8032 dollars, 501 dollars, and 7123 dollars?

	Thousands	Hundreds	Tens	Units
	6	3	1	2
	8	0	3	2
		5	0	1
	7	1	2	3
2	1	9	6	8

We first write the numbers under one another, so that all the units may stand in a column on the right hand. We then add the units thus—3 and 1 are four, and 2 are six, and 2 are eight; and we write 8 under the column of units. We next add the column of tens, and, finding their sum to be 6, we write 6 under the column. In the same manner we add the hundreds, and the thousands.

Find the sum of the numbers in each of the following examples, by addition upon the slate.

(2).	(3).	(4).	(5).
51	733	6243	24031
4	120	4123	1320
60	12	9401	40214
43	634	130	34314

SECTION 2.

1. Add the following numbers into one sum. 4638 and 216 and 8329 and 1212.

	Thousands	Hundreds	Tens	Units
	4	6	3	8
		2	1	6
	8	3	2	9
	1	2	1	2
1	4	3	9	5

Finding the sum of the units to be 25, or 2 tens and 5 units, we write only the 5 units, and presently add the 2 tens in with the column of tens. In adding the hundreds, we find their sum to be 13. Now if we should write down 13, the 3 would stand under the column of hundreds, and the 1, under the column of thousands; therefore we write the 3 only, and presently add the 1 in with the thousands

In the following examples, observe, that when the sum of any column amounts to more than 9, you must set down only the right hand figure of it, and, must add the left hand figure to the next column.

(2).	6214	(3).	5221	(4).	7420	(5).	3150
	2403		7540		612		216
	590		1368		2541		8481
	8732		520		9103		275
	1217		5648		430		8610
	2464		7300		1000		2541

RULE FOR ADDITION. *Write the numbers, units under units, tens under tens, &c. Add each column separately, beginning with the column of units. When the sum of any column is not more than* 9, *write it under the column. when the sum is more than* 9, *write only the units' figure under the column, and carry the number of tens to the next column. Finally, write down the whole sum of the left hand column.*

6. Add together the numbers, 143 and 8 and 56 and 7.
7. Add together the numbers, 3 and 96 and 5 and 984.
8. What is the whole sum of 26, 9, 18, 153 and 728?
9. What is the whole sum of 8, 6, 42, 728 and 4105?
10. What is the whole sum of 44, 536, 827 and 3480?
11. *What is the whole sum of 1118, 6004, and 84932?
12. What is the whole sum of 61297, 58 and 389163?
13. Find the sum of 423, 315, 531, 414, 612, 234, 621, 414, 711, 144, 621 and 918.
14. Find the sum of 314, 90, 246518, 7, 1101, 47, 3430, 8601520, 2004 and 5674.
15. Find the sum of 1728, 26510, 34, 100, 3261, 9, 245, 1640831, 6733 and 40000000.
16. A clerk received from one man 94 dollars, from another 361 dollars, and from another 113 dollars. What was the whole sum of money received?
17 A merchant sent to the bank at one time 301 dollars; at another 214; at another 1109; at another 109. How much did he send in all?

18. A certain lot of land has been divided into three farms; one of the farms contains 112 acres, another 123 acres, and the other 147 acres. How many acres were there in the original lot?

19. If you start on a journey, and travel on Monday 42 miles, on Tuesday 57, on Wednesday 49, on Thursday 54, on Friday 63, and on Saturday 75, how far will you have travelled at the end of the week?

20. Suppose 477 dollars are in one bag, 8509 in another, 1965 in another, and 956 in another; what sum of money is there in the four bags?

21. A merchant bought a quantity of sugar for 2075 dollars, and then sold it so as to gain 415 dollars. For how much did he sell the sugar?

22. There are four numbers, the first of which is 532, the second 895, the third 240, and the fourth as much as the other three. What is the sum of them all?

23. A broker, by selling a note for 836 dollars, lost 140 dollars. What must he have paid for the note?

24. A capitalist gave to one of his sons, 13427 dollars; to another, 13025 dollars; to another, 12947 dollars. What did he give to all of them?

25. Sacred history shows, that the time, from the creation of the world to the Deluge, was 1656 years, thence to the building of Solomon's temple, 1344 years, thence to the birth of Christ, 1004 years. How old is the world the present year?

26. George Washington was born in the year 1732, and lived to be 67 years old. In what year did he die?

27. Three men united in trade;—the first man had 5136 dollars, the second had 1562 dollars, and the third had 756 dollars. How much had they all?

28. A trader bought four pieces of cloth: the first piece contained 86 yards; the second, 55 yards; the third, 87 yards and the fourth 91 yards. What was the cost of the whole, at 1 dollar per yard?

29. A gentleman purchased a farm for 8257 dollars, paid 953 dollars for having it fenced, and 300 dollars for having a barn built upon it. For how much must he sell it, in order to gain 100 dollars?

30. A drover paid 300 dollars for 100 sheep, 525 dollars for 150 sheep, and 1000 dollars for 250 sheep How many did he buy? What did the whole cost?

31. What is the sum of two million, five hundred thirty-one thousand, one hundred and twenty,—fourteen thousand,—thirty thousand and twenty-four,—five hundred and sixty,—and seven hundred and two?

32. The inhabitants of the British Islands are stated thus: England, 11 260 555; Wales, 717 10[illegible] Scotland, 2 092 014; Ireland, 6 846 949; Army and Navy, 310 000; Isle of Man, 40 981; Guernsey, 20 827; Jersey, 28 600; Scilly Isles, 2 614. What is the whole number?

33. The inhabitants of the United States, by the census of 1840, were stated thus: Maine, 501 793; New Hampshire, 284 574; Massachusetts, 737 699; Rhode Island, 108 830; Connecticut, 309 978; Vermont, 291 948; New York, 2 428 921; New Jersey, 373 306; Pennsylvania, 1 724 033; Delaware, 78 085; Maryland, 470 019; Virginia, 1 239 797; North Carolina, 753 419; South Carolina, 594 398; Georgia, 691 392; Alabama, 590 756; Mississippi, 375 651; Louisiana, 352 411; Tennessee, 829 210; Kentucky, 779 828; Ohio, 1 519 467; Indiana, 685 866; Illinois, 476 183; Missouri, 383 702; Arkansas, 97 574; Michigan, 212 267; Florida, 54 477; Wiskonsan, 30 945, Iowa, 43 112; District of Columbia, 43 712. What was the whole number?

Questions to be answered Orally.

(1) When you have several numbers to add together, in what order do you write them? (2) Which column do you add first? (3) Do you add all other columns in the same manner that you add the first? (4) When the sum of any column is less than 10, where is it to be written? (5) When the sum of any column is more than 9, what is to be done? (6) Why do we carry as many *ones* to the next left hand column, as there are *tens* in any column that we have added? (7) Recite the rule for addition.

CHAP. III.

SUBTRACTION.

Section 1.

1. Subtract 632 from 1847; that is, take 632 from 1847, and find what number remains.

```
1847
 632
----
1215
```

We first write the smaller number under the greater. Then, take 2 units from 7 units, 3 tens from 4 tens, 6 hundreds from 8 hundred, and nothing from 1 thousand.

Subtract the smaller number from the greater in each of the following examples.

(2).	(3).	(4).	(5).
25	639	4258	705684
12	213	3215	4261

6. A farmer having 359 sheep, sold 136 of them, and kept the remainder. How many did he keep?

7. A trader having 2748 dollars, laid out 2616 dollars for goods. How many dollars had he remaining?

Section 2.

1. Subtract the number 1528 from the number 8473.

```
8473
1528
----
6945
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We unite 1 of the 7 tens with the 3 units, making 13 units, and say, 8 from 13, leaves 5. Then, having used 1 of the 7 tens, we take 2 tens from 6 tens. In the same way we take 5 hundreds from 14 hundreds.

Do not pass from the above example without understanding it. Whenever an upper figure is smaller than the figure under it, we use 1 from the next upper figure, and this 1 becomes 10 when considered with the right hand figure. Arithmeticians commonly call this process, *borrowing* 10; and, instead of reckoning the figure from which they have *borrowed* to be 1 less than it stands, they *pay* 1 to the figure under it—reckoning the lower figure to be 1 more than it stands.

Perform subtraction in the following examples.

(2).	(3).	(4).	(5).
1853	5264	2657	6807
1370	762	349	4096

6. Subtract 1268 from 1503.

1503
1268
235

In subtracting the 8 units, we use a *ten*, that we obtain by supposing 1 of the 5 hundreds, (which is 10 tens,) to be where the 0 is. Then, having used 1 of the 10 *tens*, we presently subtract 6 tens from 9 tens.

7. Subtract 1146 from 2601.
8. Subtract 5428 from 8019.
9. Subtract 258 from 84307.

RULE FOR SUBTRACTION. *Write the smaller number under the greater, placing units under units, &c. Begin with the units, and subtract each figure in the lower number from the figure over it. When a figure in the upper number is smaller than the figure under it, consider the upper figure to be* 10 *more than it is, and the next upper figure on the left hand, to be* 1 *less than it is.*

PROOF. *Add together the remainder and the smaller number: their sum will be equal to the greater number, if the work be right.*

10. Find the difference between 39 and 64, by subtracting the smaller number from the greater.

11. What is the difference between 464 and 502?

12. What is the difference between 99 and 200?

13. What is the difference between 35720 and 9100?

14. Subtract 44 from 10000.

15. I deposited 1450 dollars in the bank, and I have since drawn out 835 dollars. How many dollars have I remaining in the bank?

16. Suppose a man owes 1634 dollars, and possesses property to the amount of 8150 dollars: how much will he have left, after paying his debts?

17. Subtract sixty-two thousand five hundred and seven, from one million eighty thousand and forty-four.

18. The number of inhabitants in the city of London is 1 250 000; the number in the city of Paris is 750 000. How many more are there in London, than in Paris?

19. The population of Great Britain and Ireland is 21 500 000; the population of France is 32 000 000. How many more inhabitants are there in France, than in Great Britain and Ireland?

20. The Rocky Mountains, in North America, rise 12 500 feet above the level of the ocean; the Andes, in South America, rise 21 440 feet. How many feet higher are the latter, than the former?

21. A merchant paid 13 745 dollars for a ship, and sold it for 15 150 dollars. What did he gain?

22. A farmer sold a piece of wood-land for 396 dollars, which was 78 dollars more than he gave for it How much did he give for the land?

23. Columbus discovered America in the year 1492. How many years is it since the discovery?

24. The United States declared Independence in the year 1776. How many years since the declaration?

25. A man bought 20 casks of wine, containing 2459 gallons, and sold 14 casks containing 1682 gallons. How many casks, and how many gallons were left?

26. There are two numbers, whose difference is 758; the greater number is 1524. What is the smaller number?

Questions to be answered Orally.

(1) How can you find what the difference is between two numbers? (2) When one number is to be subtracted from another, in what order must the numbers be written? (3) In what place do you begin to perform the subtraction? (4) When a figure in the upper number is smaller than the figure under it, what is to be done? (5) Where does the remainder appear, after the subtraction is performed? (6) Recite the rule for subtraction. (7) How can you prove that an operation in subtraction is performed correctly?

SECTION 3.

MISCELLANEOUS EXAMPLES.

1. A man owing 379 dollars, paid at one time 47 dollars, at another 23, at another 84, and at another, 143 How much did he still owe?

2. There are 1000 dollars in 4 bags; the first bag contains 230 dollars, the second 245, the third 270. What is contained in the fourth bag?

3. Suppose the world to have been created 4004 years before the Christian era, how old is it at this date?

4. A man having in his desk 2000 dollars, took out 120 dollars to pay a debt, and afterwards put in 75 dols. How much was there remaining in the desk?

5. A merchant bought a ship for 11 240 dollars, paid 305 dols. for repairing it, and sold it so that he lost 95 dols. For how much did he sell it?

6. What is the sum of 58, 45, and 70? Then, if you subtract 43 from this sum, what will be the remainder?

7. A merchant, who had 650 barrels of flour, sold 95 barrels to one man, 38 to another, and 225 to another How many barrels had he left?

8. A jockey bought a horse for 115 dollars; he exchanged him for a better horse, paying 23 dollars, and then sold the better one for 137 dollars. Did he gain or lose?--and how much?

9. If 654 be subtracted from 10000, and then 29670 be added to the remainder, what will be the sum?

10. A gentleman gave 972 dollars for a carriage and two horses; the carriage was valued at 525 dollars. What was the value of the horses?

11. Dr. Franklin died in the year 1790, and he was 84 years old when he died. In what year was he born?

12. A clerk went out with 240 dollars, to settle some accounts: he paid 126 dollars to one man, received 37 dollars from another, and paid 94 dollars to another How many dollars had he then?

13. Add together two hundred, sixteen thousand, thirteen million, and seven billion; and then subtract ten thousand from the sum.

CHAP. IV.

MULTIPLICATION.

SECTION 1.

1. If a gunner shoot 72 pigeons every time he goes a gunning, how many will he shoot in going 3 times?

We might here obtain the answer by adding together, 72 and 72 and 72; but we shall obtain it more readily by multiplying 72 by 3; that is, by finding 3 times 72.

Multiplicand	72
Multiplier	3
Product	216

We write 72, and write 3 under it. Then we multiply the 2 units and the 7 tens separately, thus, 3 times 2 are 6; 3 times 7 are 21.

Observe, that the number which we multiply is called the *multiplicand;* the number by which we multiply is called the *multiplier;* and the number which we obtain by multiplication is called the *product.*

Find the product in each of the following examples.

(2).	(3).	(4).	(5).
61	524	9132	420121
4	2	3	4

6. If a farm produce 230 bushels of wheat a year, how many bushels will it produce in 3 years?

7. Multiply 512 by 4;—that is, find 4 times 512.

SECTION 2.

1. Multiply 743 by 6;—that is, find 6 times 743.

743
6
4458

6 times 3 are 18, or 1 *ten* and 8 *units;* we write only the 8 units, (as in addition), and proceed;—6 times 4 are 24 and 1 we carry are 25; we write the 5 and proceed.

Find the product in each of the following examples.

(2)	(3).	(4).	(5).
5236	1908	6175	3640
4	2	5	8

6. What will 3 books cost, at 31 cents apiece?
7. What will 4 slates cost, at 24 cents apiece?
8. What will 5 baskets cost, at 17 cents apiece?
9. What will 6 cows cost, at 25 dollars apiece?
10. What will 7 horses cost, at 115 dollars apiece?
11. How many are 8 times 9?
12. How many are 9 times 16?
13. How many are 5 times 342?
14. How many are 7 times 6453?
15. How many are 3 times 42 908?
16. How many are 6 times 704 370?
17. Multiply 251 by 8,—that is, find 8 times 251
18. Multiply 475 by 4.
19. Multiply 3086 by 6.
20. Multiply 15 350 by 8.
21. Multiply 430 039 by 7.
22. Multiply 7 000 005 by 9.
23. Multiply 42 862 000 by 5.
24. Multiply 928 064 309 by 4.
25. Suppose 8 to be a multiplicand, and 6 the multiplier; how much will be the product?
26. Suppose 35 to be a multiplicand, and 7 the multiplier; how much will be the product?
27. Suppose 491 to be a multiplicand, and 5 the multiplier; how much will be the product?

SECTION 3.

1. Multiply 657 by 24.

$$\begin{array}{r} 657\\ 24\\ \hline 2628\\ 1314\\ \hline 15768 \end{array}$$

We first multiply by the 4 units. Then we multiply by the 2 tens, and since this product must be ten times greater than it would be if the 2 were 2 units, we set the product one place to the left. At last, we add the two products together, and the sum is the whole product of 657 by 24.

2. Multiply 75 by 16.
3. Multiply 634 by 45.
4. Multiply 3291 by 63.
5. Multiply 71 538 by 77.
6. Multiply 428 601 by 81.

RULE FOR MULTIPLICATION. *Write the multiplier under the multiplicand, placing units under units, &c.*

When there is but one figure in the multiplier, begin with the units, multiply each figure in the multiplicand separately, and place each product under the figure in the multiplicand from which it arose; observing to carry the tens to the left as in addition.

When there is more than one figure in the multiplier, multiply by each figure separately, and write its product in a separate line, placing the right hand figure of each line under the figure by which you multiply; and finally, add together the several products. The sum will be the whole product.

7 Suppose 5 476 208 to be a multiplicand, and 3942 the multiplier; how much will be the product?

$$\begin{array}{r} 5476208 \\ 3942 \\ \hline 10952416 \\ 21904832 \\ 49285872 \\ 16428624 \\ \hline 21587211936 \\ \hline \end{array}$$

8. Suppose 73 054 to be a multiplicand, and 548 the multiplier; how much will be the product?

9. Suppose 295 to be a multiplicand, and 486 the multiplier; what will be the product?

10. What is the product of 9351 by 765?

11. What is the product of 3008 by 254?

12. What is the product of 5603 by 6448?

13. How many are 74 times 6580?

14. How many are 236 times 3759?

15. There is an orchard containing 9 rows of trees, and there are 57 trees in each row. How many trees are there in the orchard?

16. A merchant bought 75 pipes of wine, at 145 dollars a pipe. What did the whole cost?

17. A merchant bought 37 mules, for shipping, at 58 dollars per head. What did the whole cost?

18. A man travelled 26 days, travelling 47 miles a day. How far did he travel in the whole time?

19. A merchant sold 342 tons of iron, at 142 dollars per ton. What was the price of the whole?

20. If a coach wheel turn round 346 times in 1 mile, how many times will it turn round in the distance from New York to Philadelphia, it being 95 miles?

21. A prize was divided among 47 men, and each man received 25 dollars. How much was the prize?

22. What sum of money must be divided among 45 men, so that each man shall receive 59 dollars?

23. A merchant bought 7 bales of cloth, each bale containing 11 pieces, and each piece, 29 yards. How many pieces, and how many yards were there?

24. A trader bought 9 pieces of cloth, e[illegible]ce containing 42 yards, at 6 dollars a yard. H[illegible]any yards were there, and what did the whole cost?

25. If hats are worth 7 dollars apiece, what are 15 boxes of hats worth, each box containing 24 hats?

26. The distance from Washington to Boston is 436 miles; and in each mile there are 320 rods. How many rods is it from Washington to Boston?

27. The distance from Washington to New-Orleans is 1255 miles. How many rods is it?

28. What is the value of the hay, that is produced on 16 farms; allowing each farm to produce 62 tons, and allowing the hay to be worth 12 dollars a ton?

29. There are 24 hours in a day, and 365 days in a year. If a ship sail 7 miles in an hour, how many miles will she sail in a year?

30. How many days' work can 9 men do in 24 days?

31. How many days will it take 1 man to perform a piece of work, that 9 men will perform in 24 days?

32. How many days will it take 1 man to build a piece of road, that 13 men can build in 47 days?

33. How many men must be employed to do a piece of work in 1 day, that 11 men can perform in 18 days?

34. Suppose that a ship's crew of 13 men will drink 82 gallons of water in 14 days, how long would the same quantity of water last 1 man?

Section 4.

ABBREVIATIONS.

When there are ciphers standing between figures, in the multiplier, they may be disregarded.

1. What is the product of 12318 multiplied by 7004?

$$\begin{array}{r}
12318 \\
7004 \\
\hline
49272 \\
86226 \\
\hline
86275272
\end{array}$$

2. What is the product of 9651 multiplied by 304?
3. How many are 1001 times 57 906?
4. How many are 905 times 820 437?

Ciphers on the right hand of the multiplier or multiplicand may be disregarded till the multiplication is performed, and then placed on the right hand of the product

5. What is the product of 5763 multiplied by 3600?

$$\begin{array}{r}
5763 \\
3600 \\
\hline
34578 \\
17289 \\
\hline
20746800
\end{array}$$

6. What is the product of 158 multiplied by 350?
7. How many are 800 times 369?
8. How many are 40 times 4728?

Ciphers on the right hand of the multiplier and multiplicand both, may all be disregarded in multiplying and finally placed on the right hand of the product.

9. What is the product of 46000 multiplied by 340

$$\begin{array}{r}
46000 \\
340 \\
\hline
184 \\
138 \\
\hline
15640000
\end{array}$$

10. What is the product of 8370 multiplied by 240?
11. How many are 90 times 761000?
12. How many are 5700 times 6800?

When the multiplier is 10, 100, 1000, *&c. merely place the ciphers of the multiplier on the right hand of the multiplicand, and it becomes the product.*

13. What is the product of 5 multiplied by 10?

14. What is the product of 17 multiplied by 100?

15. What is the product of 49 multiplied by 1000?

16. In 1 dollar there are 100 cents. How many cents are there in 6 dollars?

17. How many cents are there in 25 dollars?

18. If 1 box of lemons cost 7 dollars, how many cents will it take to pay for 10 boxes?

When the multiplier is a number, that can be produced by multiplying two smaller numbers together, multiply the multiplicand first by one of the smaller numbers, and the product thence arising by the other.

19. Find the price of 32 horses, at 96 dollars apiece.

$$\begin{array}{r l} 96 & \text{price of 1 horse.} \\ \underline{8} & \\ 768 & \text{price of 8 horses.} \\ \underline{4} & \\ \underline{3072} & \text{price of 4 times 8 horses, or 32 horses.} \end{array}$$

Observe in the above example, that 32 can be produced by multiplying 4 and 8 together. The 4 and the 8 are called the *factors* of 32.

20. A merchant bought 24 hogsheads of molasses at 19 dollars a hogshead. What did the whole cost?

In this example we consider 24 to be the multiplier. For 24, we can find several different sets of factors; viz. 3, 8; also, 4, 6; also, 2, 3, 4; also, 2, 2, 6. Either set of these factors may be used.

21. If a ship sail at the rate of 129 miles a day, how many miles will she sail in 72 days?

22. If 1 man can dig 41 bushels of potatoes in a day, how many bushels can 28 men dig?

23. Multiply 425 by 36, using the factors of 36.

24. How many are 63 times 540?

25. How many are 45 times 2807?

Questions to be answered Orally.

(1) What is meant by *multiplicand?*—what by *multiplier?*—and what by *product?* (2) When we say, 5 times 8 are 40, which of these numbers is the multiplicand?—which the multiplier?—and which the product? (3) Can you obtain the product of any two numbers, by means of addition? (4) Recite the rule for multiplication. (5) When there are ciphers between figures in the multiplier, what may be done? (6) When there are ciphers on the right of the multiplier, or multiplicand, or on the right of both, what may be done with them? (7) In what manner can you multiply by 10, by 100, by 1000, &c.? (8) What is meant by the *factors* of a number? (9) Name two factors of 24. (10) Name three factors of 24. (11) Name two factors of 36. (12) Name three factors of 36.

Perform the following examples by either of the foregoing methods, which may be found convenient.

26. What is the value of a farm consisting of 200 acres of land, at 40 dollars an acre?

27. Suppose a book to contain 235 pages, 45 lines in each page, and 50 letters in each line;—how many letters are there in the book?

28. Suppose an orchard to consist of 109 rows, 126 trees in a row, and 1007 apples on a tree;—how many trees, and how many apples are there?

29 Suppose a crew of fifty men have provision for 30 days, allowing each man 20 ounces a day;—how many days would it last, if each man ate 1 ounce a day?

30. Suppose a crew of fifty men have provision for 30 days, allowing each man 20 ounces a day;—how many men would it serve for the same time, if each man ate one ounce a day?

31. How many fishes would be caught by 14 boats, employed for 30 days, each boat drawing a net 15 times a day, and taking 13 fishes each draught?

32 What is the product of 90042 multiplied by 9009?

CHAP. V.

DIVISION.

SECTION 1.

1. How many yards of cloth, at 3 dollars a yard, can be bought for 396 dollars?

Here we must find how many times 3 dollars there are in 396 dollars: that is, we must divide 396 by 3.

3)396
132

We first divide the 3 hundreds, then the 9 tens, and then the 6 units; thus, 3 in 3, once; 3 in 9, 3 times; 3 in 6, 2 times.

Observe in the above example, that the 3 which we first divide, means 3 *hundred;* and the 1 which we place under it means 1 hundred, showing that 3 is contained in 300, 100 times. The 9 means 9 *tens*, and the 3 which we place under it means 3 tens, showing, that 3 is contained in 90, 30 times.

A *Dividend* is a number which is to be divided; such is the number 396 in the above example. A *Divisor* is a number by which we divide; such is the number 3 in the above example. The *Quotient* is the number of times which the divisor is contained in the dividend; such is the number 132 in the above example.

Find the quotient in each of the following examples.

(2). 4)8 (3). 2)46 (4). 3)936 (5). 4)4884

6. A man laid out 69 dollars for sheep, paying 3 dollars a head for them. How many did he buy?

7. If 4 bushels of wheat will pay for 1 barrel of flour, how many barrels will 848 bushels pay for?

SECTION 2.

1. How many times is 4 contained in 3684?

4)3684
921

In this example we find that 4 is not contained in 3, therefore we join the 3 with the 6, and say, 4 in 36, 9 times.

2. How many times is 7 contained in 56?

3. How many times is 9 contained in 639?

4. How many times is 5 contained in 405?

5 How many times is 4 contained in 3248?

6. How many times is 3 contained in 1569?

7. If 4 horses are required to draw 1 wagon, how many wagons might be drawn by 168 horses?

8. How many yards of broad-cloth, that is sold at 6 dollars a yard, can be bought for 492 dollars?

9. If a man can travel 5 miles an hour, how many hours will it take him to travel 205 miles?

10. Suppose 69 to be a dividend, and 3 a divisor; what is the quotient?

11. Suppose 128 to be a dividend, and 4 a divisor; what is the quotient?

12. Suppose 486 to be a dividend, and 6 a divisor; what is the quotient?

13. How many times is 4 contained in 872?

$$\begin{array}{r}4)\underline{872}\\ \underline{218}\end{array}$$

4 in 8, 2 times; 4 in 7, 1 time, and there is 3 over; (we join this 3 with the 2, making 32,) then 4 in 32, 8 times.

14. How many times is 6 contained in 726?

15. How many times is 8 contained in 896?

16. How many times is 5 contained in 1605?

17. How many times is 7 contained in 924?

18. How many times is 4 contained in 6732?

19. Suppose 1585 to be a dividend and 5 the divisor; what is the quotient?

20. Suppose 4518 to be a dividend and 6 the divisor; what is the quotient?

21. How many times is 7 contained in 742?

$$\begin{array}{r}7)\underline{742}\\ \underline{106}\end{array}$$

The divisor not being contained once in the ten's place of the dividend we write a 0 in the ten's place of the quotient.

22. How many times is 3 contained in 609?

23. How many times is 8 contained in 1624?

24. How many times is 5 contained in 4015?

25. How many times is 9 contained in 2880?

26. How many times is 7 contained in 10500?

27. If I had 78 dollars to lay out for flour, and the flour was 6 dollars a barrel, how many barrels could I buy for all the money?

28. A drover received 268 dollars for sheep, that he sold at 4 dollars a head. How many were there?

29. If 1 ton of hay be worth 9 bushels of corn, how many tons of hay are 576 bushels of corn worth?

30. If 3 bushels of wheat will pay for a yard of cloth, how many yards will 105 bushels pay for?

31. How many soldiers may be clothed from 5708 yards of cloth, allowing 4 yards to make a suit?

32. How many muskets can be purchased for 2952 dollars; the price being 6 dollars apiece?

33. If 76 dollars should be divided equally among 4 men, how many dollars would each man receive?

If there were only 4 dollars to be divided, each man would receive just 1 dollar: therefore each man must receive as many dollars as there are fours in 76.

34. Suppose 5 men have to pay a bill of 95 dollars, how many dollars must each man pay?

35. If 171 biscuit be divided equally among a crew of 9 sailors, how many does each sailor receive?

36. A farmer planted 354 trees, in 6 equal rows. How many were there in 1 row?

37. A fisherman hired a boat, agreeing to give the owner 1 fish of every 7 that he might catch: he caught 434. How many should he give the owner?

38. 8 sailors received 1576 dollars for retaking their ship. How much did each sailor receive?

39. A man intending to go a journey of 336 miles, wishes to perform it in 6 days. How many miles must he travel each day?

40. 9 men have agreed to make up a purse of 2178 dollars. How many dollars must each one put in?

41. Suppose A to spend 3 dollars as often as B spends 1 dollar; how many dollars will B spend while A is spending 89004 dollars?

42. Suppose 3656 dollars have been equally divided among a number of men, and each man has received 8 dollars; how many men were there?

43. A number of men contributed 9 dollars apiece, and thereby made up a purse of 54 dollars. How many men were there?

44. Suppose 9 has been multiplied by some number, and the product is 54; what was the multiplier?

45. 5 men paid equal shares of a debt of 80 dollars How much did each man pay?

46. Suppose some number has been multiplied by 5, and the product is 80; what number was multiplied?

47. Two numbers have been multiplied together, and their product is 126: one of the two numbers multiplied is 7;—what is the other?

48. Divide 348 by 4; then prove the work to be right, by multiplying the quotient and divisor together?

$$\begin{array}{r} 4\underline{)348} \\ 87 \\ \underline{4} \\ \underline{348} \end{array}$$

We find by the quotient, there are 87 times 4 in 348. therefore we know that 87 times 4, or 4 times 87, must make 348. Had our quotient been wrong, our product and dividend would not be equal.

49. Divide 72 by 8, and prove the work to be right

50. Divide 5890 by 5, and prove the work to be right

51. Divide 39781 by 7, and prove the work to be right

52. Divide 90048 by 8, and prove the work to be right

53. Divide 17604 by 9, and prove the work to be right

54. A hatter has 130 hats finished; and, in order to send them to market, he must pack them in boxes, that will hold 8 hats apiece. How many full boxes can he send; and how many hats will remain on hand?

$$\begin{array}{r} 8\underline{)130} \\ \underline{16\ 2} \end{array}$$

We have 2 units over. This 2 is a *remainder;* it shows that there are 2 hats, which cannot be divided into eights.

55. How many sheep, at 4 dollars a head, can a butcher, who has 747 dollars buy; and how many dollars will he have remaining?

56. If 5 yards of cloth will make a suit of clothes, how many suits can be made from 96 yards; and how many yards will there be over?

57. How many times is 6 contained in 4637; and how many are there over?

58. How many times is 8 contained in 916, and how many are there over?

59. Suppose 568 to be a dividend, and 7 the divisor, what is the quotient, and the remainder?

60. Suppose 1953 to be a dividend, and 7 the divisor; what is the quotient, and the remainder?

61. Divide 564 by 7, and prove the work to be right.

The remainder, in division, is an undivided part of the dividend: therefore, the remainder must be added to the product of the divisor and quotient, to make the product equal to the dividend.

62. Divide 109 by 6, and prove the work to be right.

63. Divide 817 by 5, and prove the work to be right.

Section 3.

The method of dividing taught in the two preceding sections, is called *Short* division: the method taught in this section; is called *Long* division. In long division, we place the quotient on the right hand of the dividend, and perform some operations under the dividend, heretofore performed in the mind.

1. How many times is 4 contained in 95307?

```
Divisor  Dividend   Quotient
   4)95307(23826
     8
     --
     15
     12
     --
      33
      32
      --
       10
        8
       --
        27
        24
        --
 Remainder 3
```

Perceiving that 4 is contained in 9, twice, we place 2 in the quotient, multiply the divisor by 2, and subtract the product (8) from 9. This is the same as saying in short division, '4 in 9, 2 times, and 1 over.' Now, since the 1 over must be joined with the 5, we bring the 5 down to the right of the 1: and then, perceiving that 4 is contained in 15, 3 times, we place 3 in the quotient, multiply the divisor by 3, and subtract the product as before. Thus we proceed to bring down every figure of the dividend, and unite it with the previous remainder.

Perform the following examples by long division.

2. How many times 5 are there in 7163?
3. How many times 7 are there in 88 704?
4. How many times 6 are there in 97 547?
5. How many times 3 are there in 8 057 251?
6. How many times 4 are there in 8 708 983?
7. How many times 5 are there in 6 457 080?
8. How many times 8 are there in 25 648?

```
8)25648(3206
  24
   16
   16
     48
     48
```

The divisor not being contained once in the left hand figure of the dividend, we join this figure with the next. After bringing down the 4, we find the divisor is not contained in it; therefore, we place a 0 in the quotient, and bring down the next figure.

9. How many times 5 are there in 43 906?
10. How many times 9 are there in 70 223?
11. How many times 6 are there in 901 500?
12. How many times 7 are there in 161 635?
13. How many times 24 are there in 3762?

```
24)3762(156
   24
   136
   120
    162
    144
     18
```

This operation is performed in the same manner that it would have been, if the divisor had consisted of only one figure.

The two following examples will show the method of determining when a figure placed in the quotient is too great, and when it is too small.

14 How many times is 18 contained in 12 532?

```
18)12532(697
   108
    173
    162
     112
     126
```

In this example, we have chosen 7 for the last figure of the quotient; but it appears, that 7 times 18 are more than 112; therefore 18 is not contained 7 times in 112. The 7 and the product arising from it must be rubbed out, and a smaller figure must be placed in the quotient.

15. How many times is 35 contained in 45 817?

```
35)45817(1308
   35
   108
   105
     317
     280
      37
```

Here we have chosen 8 for the last figure of the quotient; but, after subtracting 8 times 35 from 317, there remains, 37. This remainder will contain 35, once more; therefore, we must rub out the 8 and the work resulting from it, and must put 9 in the place of 8.

16. How many times is 47 contained in 804?
17. How many times is 53 contained in 1625?
18. How many times is 68 contained in 94 605?
19. How many times is 71 contained in 661 419?
20. How many times is 108 contained in 216?
21. How many times is 325 contained in 7134?
22. How many times is 476 contained in 92 107?
23. How many times is 504 contained in 1008?
24. How many times is 651 contained in 43 126?

RULE FOR DIVISION. *When the divisor does not exceed 9, draw a line under the dividend, find how many times the divisor is contained in the left hand figure, or two left hand figures of the dividend, and write the figure expressing the number of times underneath: if there be a remainder over, conceive it to be prefixed to the next figure of the dividend, and divide the next figure as before Thus proceed through the dividend.*

When the divisor is more than 9, find how many times it is contained in the fewest figures that will contain it, on the left of the dividend, write the figure expressing the number of times to the right of the dividend, for the first quotient figure; multiply the divisor by this figure, and subtract the product from the figures of the dividend considered. Place the next figure of the dividend on the right of the remainder, and divide this number as before. Thus proceed through the dividend.

PROOF. *Multiply the divisor and quotient together, and to the product add the remainder the sum will be equal to the dividend, if the work be right.*

25. Divide 46242 by 252, and prove the operation

```
252)46242(183          252
    252                183
    ----               ---
    2104               756
    2016              2016
    ----              252
      882               126
      756             -----
      ---             46242
      126
```

26. Divide 74 201 by 625, and prove the operation

27. Divide 408 732 by 9, and prove the operation.

28. Divide 15 362 by 88, and prove the operation.

29. Divide 57 026 by 492, and prove the operation

30. Divide 982 700 by 53, and prove the operation

31. Divide 162 941 by 256, and prove the operation

32. Divide 648 035 by 14, and prove the operation.

33. Divide 106 401 by 333, and prove the operation.

34. Divide 62 509 by 4423, and prove the operation.

35. Divide 1 071 400 by 29, and prove the operation.

36. How many acres of land, at 22 dollars an acre, can be bought for 8514 dollars?

37. Suppose a man to earn 35 dollars a month; how many months will it take him to earn 490 dollars?

38. If a man travel 48 miles a day, in how many days will he perform a journey of 3264 miles?

39. If 774 dollars be divided equally among 18 sailors, how many dollars will each sailor receive?

40. If a man's income be 2555 dollars a year, how much is it a day, there being 365 days in a year?

41. The income of the Chancellor of England, is 99 280 dollars a year. How much is it per day?

42. 63 gallons of water will fill a hogshead. How many hogsheads will 5166 gallons fill?

43. How many hogsheads can be filled from 19 721 gallons?—and how many gallons will there be left?

44. Suppose a regiment of 512 men have 8192 pounds of beef; how many pounds are there for each man?

45. If a dividend be 46 319, and the divisor 807, what is the quotient?—and what the remainder?

SECTION 4.

ABBREVIATIONS.

When there are ciphers on the right hand of a divisor, cut them off, and omit them in the operation; also cut off and omit the same number of figures from the right hand of the dividend. Finally, place the figures cut off from the dividend, on the right of the remainder.

1. How many times 900 are there in 741 725?

9|00)7417|25
824 125.

We divide 7417 by 9; there remains 1, to which we annex the 25, making the true rem. 125.

2. How many times 70 are there in 8 563 512?
3. How many times 300 are there in 6374?
4. How many times 5000 are there in 46 578?
5. How many times 40 are there in 80 603?
6. How many times 600 are there 675 700?
7. How many times 8000 are there in 16 000?
8. Divide 65 237 by 50, and prove the operation.
9. Divide 567 289 by 400, and prove the operation.
10. How many times 570 are there in 35 871?
11. How many times 280 are there in 6423?
12. How many times 4200 are there in 91 621?
13. How many times 9060 are there in 287 000?

When the divisor is 10, 100, 1000, &c., cut off as many figures from the right hand of the dividend, as there are ciphers in the divisor; the other figures of the dividend will be the quotient, and the figures cut off will be the remainder.

14. How many times 10 are there in 240?
15. How many times 10 in 435; and how many over?
16. How many times 100 are there in 4000?
17. How many times 100 in 748; and how many over?
18. 100 cents are equal to 1 dollar. How many dollars are there in 5400 cents?
19. In 642 cents, how many dollars are there; and how many cents over?
20. In 1987 cents, how many dollars are there; and how many cents over?

When factors of the divisor can be found, (that is, when two numbers can be found, which, being multiplied together, produce the divisor,) you may divide the dividend by one of the factors, and the quotient thence arising by the other: the last quotient will be the true one.

21. In a certain school there are 36 scholars, among whom 540 quills are to be equally divided. How many will 1 scholar receive?

Let us suppose the school to be divided into 4 classes, allowing 9 scholars to be in each class. Then we will find how many quills 1 class will receive, and from this number, find how many 1 scholar will receive.

$4\underline{)540}$ number of quills for the school.
$9\underline{)135}$ number of quills for 1 class.
$\underline{15}$ number of quills for 1 scholar.

Observe in the above example, that the divisors 4 and 9, are the factors of 36: and, if we had divided first by the 9, and then by the 4, our last quotient would have been the same it now is.

22. Divide 11 376 by 72; using the factors of 72.

23. If 1024 dollars be divided equally among 64 men, how many dollars will 1 man receive?

24. How many times is 42 contained in 1176?

25. If 27 yards of cloth cost 216 dollars, how many dollars does 1 yard cost?

26. Suppose 1952 to be a dividend, and 32 the divisor; what is the quotient?

To obtain the true remainder, where factors have been used as divisors, multiply the last remainder by the first divisor, and to the product add the first remainder.

27. Suppose 622 to be a dividend, and 35 the divisor; what is the quotient; and what the remainder?

28. Suppose 99 to be a dividend, and 25 the divisor, what is the quotient; and what the remainder?

29. Suppose 4862 to be a dividend, and 81 the divisor; what is the quotient; and what the remainder?

30. Divide 1739 by 56

Questions to be answered Orally.

(1) When we say, '3 is contained in 20, 6 times, and 2 over,' which of these numbers have we for the dividend?—Which for the divisor?—Which for the quotient?—Which for the remainder? (2) What is meant by the *dividend*? (3) What is meant by the *divisor*? (4) What is meant by the *quotient*? (5) What is meant by the *remainder*? (6) Can the remainder ever be equal to, or greater than the divisor?—Why? (7) Suppose you have a number of dollars to divide among a number of men; which number do you make the dividend;—and which the divisor? —If there be a remainder, will it be so many dollars, or so many men? (8) Recite the rule for division. (9) How do you proceed when there are ciphers on the right hand of the divisor? (10) How do you divide by 10, 100, 1000, &c.? (11) How can you divide by means of factors? (12) When you have divided by the factors of the divisor, how do you find the true remainder? (13) How do you prove an operation in division?

Perform the following examples by either of the foregoing methods, which may be found convenient.

31. Suppose it takes 7 bushels of apples to make a barrel of cider, how many barrels of cider can be made from 945 bushels of apples?

32. Suppose an acre of land properly cultivated, to produce 38 bushels of corn; how many acres must be cultivated to produce 4902 bushels?

33. If 50 dollars will pay for an acre of land, how many acres can be bought for 6900 dollars?

34. How many days will a ship be in sailing from New York to Liverpool; allowing the distance to be 3000 miles, and the ship to sail 100 miles a day?

35. A vintner wishes to put 6615 gallons of wine into hogsheads that will hold 63 gallons apiece;—how many hogsheads must he have?

36. If you had 118 dollars, how many hats could you pay for, at 5 dollars apiece; and what number of dollars would you have left?

37. Suppose a drover has 2130 dollars; how many oxen can he pay for, at 47 dollars apiece; and how many dollars will he have left?

38. In 668 360 yards of cloth, how many pieces, and how many bales; there being 35 yards in each piece, and 56 pieces in each bale?

39. If 4810 dollars be shared equally among 130 men, how much will each man receive?

40. A farmer planted 2072 trees in 14 equal rows. How many did he plant in a row?

41. A gentleman wishes to spend 136 days in performing a journey of 3264 miles. How many miles must he travel each day?

42. If a man whose property is valued at 21 148 dollars be worth 17 times as much as his neighbor, how much is his neighbor worth?

RETROSPECTIVE OBSERVATIONS.

In the course of the last four chapters, you have practised four kinds of operations on numbers: viz. Addition, Subtraction, Multiplication, and Division. These operations should be perfectly understood—the effect of each should be distinctly perceived; for, it is on their proper application, that the solution of all questions in arithmetic depends.

Addition is the operation by which two or more numbers are united in one sum.

Subtraction is the operation by which the difference between two numbers is found.

Multiplication is the operation by which a number is produced, equal to as many times one given number, as there are units in another given number.

Division is the operation by which we find how many times one number contains another,—and, by which we divide one given number into as many equal parts, as there are units in another given number.

Questions to be answered Orally.

(1) How many kinds of operations are practised on numbers? (2) What are they called? (3) What is Addition? (4) What is Subtraction? (5) What is Multiplication? (6) What is Division? (7) Propose a question that you would solve by addition. (8) Propose a question that you would solve by subtraction. (9) Propose a question that you would solve by multiplication. (10) Propose a question that you would solve by division. (11) How can a question in multiplication be solved by addition? (12) How can a question in division be solved by subtraction?

SECTION 5.

MISCELLANEOUS EXAMPLES.

1. The population of the world has been estimated to be as follows. North America, twenty-six millions; South America, twelve millions; Europe, two hundred and twenty millions; Asia, five hundred millions; Africa, thirty-eight millions; Australia, four millions. What is the whole number?

2. In 1830, the national debt of the United States was 48 565 406 dollars; in 1831 it was 39 123 191 dollars. How much was paid in one year?

3. The national debt of England cannot be less than 1 900 000 000 dollars. How many years would it take to pay this debt, allowing ten millions of dollars to be paid annually?

4. What would be the expense of laying a rail-way from Louisiana to Maine; the distance being 1800 miles, and the rail-way costing 14 000 dollars a mile?

5. In how many days could a passage be effected from Maine to Louisiana, on the proposed rail-way; allowing a car to run 25 miles an hour, day and night?

6. How many days would it take a man to ride on horseback from Maine to Louisiana, riding 5 miles an hour, and 10 hours a day?

7. Light passes from the sun to the earth—a distance of 95 millions of miles—in about 8 minutes. What distance does light move in a minute?

8. The diameter of the earth is 7912 miles; and the diameter of the sun is 112 times as great. What is the diameter of the sun?

9. The income of the Bishop of Durham, in England, is 106 560 dollars per annum. How many clergymen would this support, on a salary of 800 dollars per annum?

10. Five men and three boys found a sum of money, and divided it so that each man had 43 dollars and each boy 26 dollars. What sum did they find?

11. If a trader buy 558 barrels of flour at 5 dollars a barrel, and pay 14 dollars for storage, for how much must he sell the flour, to gain 160 dollars?

12. Suppose 5 bushels of wheat to make a barrel of flour, how many barrels of flour can be made from 12 bins of wheat, each bin containing 95 bushels?

13. In 12 times 95, how many times 5?

14. If a farmer sell 45 acres of land at 38 dollars an acre, and divide the money equally among 4 sons and 1 daughter, what is each one's share?

15. A man, who owned 520 acres of land, purchased 376 acres more, and then divided the whole into 8 equal farms. How many acres did each farm contain?

16. In 520 plus 376, how many times 8?

17. If a man's income be 1349 dollars a year, and his expenses 3 dollars a day, how much will he lay up in a year; there being 365 days in a year?

18. A merchant gave 39 240 dollars for a cargo of sugar, and after selling it, found he had gained 1671 dollars. For how much did he sell it?

19. A merchant gave 18 dollars a hogshead for 245 hogsheads of molasses, and then sold the whole for 4000 dollars: did he gain or lose;—and how much?

20. A lot of land was divided into 8 farms, and each farm contained 150 acres. How many acres were there in the whole lot?

21. If a man's expenses are 2 dol. a day, and his income 17 dol. a week; what will he save in 7 weeks?

22. Three men bought a ship: the first man paid 2274 dollars; the second paid 3 times as much as the first, and the third paid as much as the first and second both. What was the price of the ship?

23. A hogshead holds 63 gallons. How many gallons of wine are there in 20 hogsheads; allowing that each hogshead wants 5 gallons of being full?

24. If a man earn 36 dollars a month, how many months will it take him to earn 576 dollars?

25. If a man earn 40 dollars a month, and spend 13 dollars a month, how many months will it take him to lay up 297 dollars?

26. A farmer having 20 barrels of pork, sold 9 barrels at 22 dollars a barrel, and the remainder at 19 dollars a barrel. What did he get for the whole?

27. If a trader, who has 152 barrels of flour, should lay out 1370 dollars in buying more flour, at 5 dollars a barrel, how many barrels would he have?

28. A trader hired 650 dollars, and in 6 months paid all but 92 dollars. How much did he pay?

29. What is the value of 139 yards of broad-cloth, at 7 dollars per yard?

By the method of reasoning heretofore practised, we should say in this solution, 139 yards are worth 139 times 7 dollars; and thus we should make 7 the multiplicand, and 139 the multiplier. But since it is more convenient to make the smaller number the multiplier, we reason thus,—If the value of 1 yard were 1 dollar, the value of 139 yards would be 139 dollars; since the value of 1 yard is 7 dollars, the value of 139 yards is 7 times 139 dollars: and accordingly we make 139 the multiplicand, and 7 the multiplier.

30. A trader bought 240 sheep, at 4 dollars a head, and paid for them in cows, at 20 dollars a head. How many cows did he give?

31. If I pay 6 dollars an acre for the ploughing of 18 acres of land, and 100 dollars for having the whole planted and hoed, what does the cultivation cost?

32. How many cows at 19 dollars a head, will pay for 38 sheep at 4 dollars a head?

33. A farmer bought a field, valued at 150 dols., for which he gave 9 cows, valued at 14 dols. apiece, and the rest in money. How much money did he pay?

34. What number must be added to 9 times 14, in order that the sum shall be 150?

35. If a stage travel 13 miles in the same time that a wagon travels 5 miles, how many miles will a stage travel while the wagon is travelling 65 miles?

36. Suppose that 9 bushels of wheat will fill a hogshead; how many hogsheads can be filled from a heap containing 149 bushels; and how many bushels will be left in the heap?

37. Charles and Joseph are studying arithmetic. Charles is 322 examples in advance of Joseph, but Joseph performs 55 examples in a day, and Charles, 41. In how many days will J. overtake C.?

38. Two men started together and travelled on the same road, at the rate of 7 miles an hour: but one of them rested 1 hour in every 3 hours, and the other rested 1 hour in every 4 hours. How far apart were they, at the end of 12 hours?

39. A drover, having 599 dollars, wishes to buy all the oxen he can pay for, at 34 dollars a head, and then lay out the remainder of his money for sheep, at 3 dollars a head. How many of each must he buy?

40. A, B, and C made up a purse of 500 dollars. A put in 16 dollars, and B put in 3 times as much. How much did C put in?

41. A merchant bought 64 tons of hemp at 215 dollars a ton. How many ten-dollar bank notes did it take to pay for the hemp?

42. A merchant paid 9600 dollars for 43 tons of hemp. At how much must he sell the hemp per ton, in order to gain 247 dollars?

43. What number must be subtracted from 7342, in order that the remainder shall be 456?

44. What number must be multiplied by 30, in order that the product shall be 2130?

45. What number must be divided by 15, in order that the quotient shall be 640?

SECTION 6.

FEDERAL MONEY.

Federal money is the national currency of the United States. Its several denominations are,— the MILL, the CENT, the DOLLAR, and the EAGLE.

10 mills are equal in value to 1 cent.
10 cents are equal to 1 dime.
10 dimes, or 100 cents, are equal to 1 dollar.
10 dollars are equal to 1 eagle.

In commerce, we express eagles in dollars, and dimes in cents. For example, instead of saying, 2 eagles and 5 dollars, we say, 25 dollars: and instead of saying, 3 dimes and 4 cents, we say, 34 cents.

1. How many cents are there in 86 dollars? (See method of multiplying by 100, in page 106.)
2. How many cents in 7 dollars and 58 cents?
3. How many dollars are there in 3700 cents? (See method of dividing by 100, in page 116.)
4. How many dols. and how many cts. over, in 534 cts.?

This character, $, placed before a number, shows the number to express dollars. For example, $12, is 12 dollars. When dollars and cents are expressed in one sum, they are separated by a point, thus, $4.16; to be read, 4 dollars and 16 cents. Observe, there must be two places of figures for cents: therefore, if the cents be less than 10, a cipher must be placed on the left hand of the figure which expresses them. For example, 56 dollars and 9 cents is written thus, $56.09.

5. What is the whole sum of $34.25, $18.04, $142, $176.81, and 58 cents?

```
 34.25
 18.04
142
176.81
   .58
-------
$371.68
```

In writing these numbers for addition, we place dollars under dollars, and cents under cents. We then add up each column, just as we add the columns of simple numbers. Finally, we point off two figures on the right of the sum for cents, and the other figures are dollars.

6. What is the sum of $57.20, $6.02, and $81.16?

7. Add together $538, $1.52, $5.07, and 68 cents.

8. Add together 18 cents, $70.19, $56, and 7 cents.

9. Add together 36 dollars, 7 dollars and 45 cents, 86 cents, 130 dollars and 6 cents, and 340 dollars.

10. Add together 9 dollars, 1 dollar and 70 cents. 3 dollars and 7 cents, 50 cents, and 10 cents.

11. Add together 47 cents, 62 dollars, 9 dollars and 12 cents, 5 dollars and 5 cents, and 3 dollars.

12. Add together 37 dollars, 4 dollars and 17 cents, 96 dollars and 1 cent, 99 cents, and 2 dollars.

13. What is the expense of one quarter's schooling, allowing $19 for board, $9 for tuition, $3.75 for books, and 92 cents for stationary?

14. A sailor paid $16.35 for a hogshead of molasses, in New Orleans, and also paid $3.40 for the freight of the molasses to Boston. For how much must he sell it in Boston, in order to gain $4?

15. Subtract $4.35 from $6.48; taking cents from cents, and dollars from dollars.

16. Subtract $7.18 from $48.50.

17. Subtract $251.12 from $546.18.

18. Subtract $47.56 from $319.

```
 319.00
  47.56
 ------
$271.44
```

In writing these sums of money for subtraction, we supply the places of cents in the greater sum, by ciphers, and then proceed to subtract.

When either of the sums of Federal money presented for subtraction has no cents expressed, the places of cents may be supplied by two ciphers.

19. Subtract $654 from $783.48.

20. Subtract $31.12 from $5390.

21. Subtract 42 cents from $51.

22. Subtract 7 cents from $1.

23. Subtract 5 cents from $754.

24. Subtract 4 cents from $4.

25. What is the difference between $3.06, and $9?

26. What is the difference between $6, and 7 cents?

27. A lady having $3, paid $1.15 for a yard of cambric. How much money had she left?

28. A farmer sold a barrel of pork for $21.50, taking in payment a hogshead of salt at $5, and the rest in money. How much money did he receive?

29. A trader began business with $648, and at the end of 2 years, had $911.06. What did he gain?

30. A traveller having no money, sold his horse for $92.75, and his gig for $78, and then paid $17 for passage home. How much money did he bring home?

31. A jockey gave $120 for a horse, and then exchanged for another horse, receiving $15.30 for difference of value, and then exchanged again, paying $28.50. How much did the last horse cost him?

32. How much is 18 times $4.72?

$$\begin{array}{r} 4.72 \\ 18 \\ \hline 37\;76 \\ 47\;2 \\ \hline \$84.96 \\ \hline \end{array}$$

$4.72 is the same as 472 cents: therefore we multiply it as 472 cents, and the product is 8496 cents. Now to change these cents to dollars, we must divide them by 100: this we do, by pointing off two figures for a remainder. The quotient is dollars, and the remainder is cents.

33. How much is 4 times $1.08?

34. How much is 7 times $52.31?

35. How many dollars are 8 times 75 cents?

36. How many dollars are 32 times 25 cents?

37. How much is 19 times 43 cents?

38. How much is 241 times $654.12?

39. What is the value of 6 pounds of Hyson tea, a $1.20 cents per pound?

40. What is the value of 10 yards of flannel, at 64 cents per yard?

41. What is the value of 6 hats, at $6.47 apiece?

42. What will a laborer receive for 25 days' work, at $1.15 per day?

43. How much must be paid for 30 pounds of coffee, when the price is 16 cents a pound?

44. How much must be paid for 12 drums of figs, when the price is $1.55 a drum?

45 What is the value of 147 bushels of apples, at 8 cents per bushel?

It is more convenient in this example, to make the number of bushels the multiplicand and the number of cents the multiplier. For method of reasoning, see remarks in section 5, under example 29.

46. If a man spend 28 cents a day, how much will he spend in 365 days, or 1 year?

47. What is the cost of 430 pounds of chocolate, at 20 cents per pound?

48. At 6 cents a pound, what is the value of a quarter of beef, weighing 214 pounds?

49. At $2.30, [230 cents] an acre, what is the value of 4748 acres of wild land?

When the price of a single article is given in Federal money, and the value of any number of that article is required, either the price may be multiplied by the number of articles, or the number of articles by the price; the product will be the answer.

50. At $1.72 per pound, what is the value of 5 chests of tea, each chest containing 64 pounds?

51. A trader gave $5.16 a barrel for 2170 barrels of flour, and sold it so as to gain $100.50 on the whole. For how much did he sell it?

52. A man bought 30 yards of cloth at $1.32 per yard, and 30 yards at 86 cents per yard. How much more did the first piece cost, than the last?

53. If I pay 22 cents a gallon for 72 hogsheads of molasses, each hogshead containing 63 gallons, and then sell the whole for $936, how much do I lose?

54. A man having $350, took a journey of 700 miles, paying 6 cents a mile for stage passage, and $14 for board. How much money did he bring home?

55. If a man earn $1.02 a day, and spend 36 cents a day, how much will he lay up in 75 days?

56. If a man get $8.36 for every 6 days' work, how much will he get by working 510 days?

57. Suppose 42 casks to contain 46 gallons of wine each; what is the value of the whole, at $1.11 per gal.?

58. How many times 7 cents are there in $430.78?

```
7)430.78
  ------
   61 54
```

We divide $430.78 as if the figures stood to express the whole in cents The quotient is the *number of times*

59. How many times 6 cents are there in $20.22?

60. How many times 15 cents are there in $11.10?

61. How many times 90 cents are there in $27.00?

62. How many times $4.06, [406 cents,] are there in $190 146.04, [19014604 cents]?

63. How many lead pencils can you buy for $3.44, when they are sold at 8 cents apiece?

64. How many pounds of butter, at 21 cents per pound, can be bought for $3.57?

65. A laborer earned $53.75, by working at $1.25 a day. How many days did he work?

66. If 84 cents should be divided equally among 6 boys, what would each boy receive?

67. If $28.71 [2871 cents] be divided equally among 9 men, what will each man receive?

68. If $205.58 be divided equally among 38 men, what will each man receive?

69. If $637 be divided equally among 24 men, what will each man receive?

```
24)637(26
   48
   ---
   157
   144
   ------
  24)1300(54
     120
     ---
      100
       96
       --
        4
```

Answer, $26.54.
Remainder, 4 cents.

After dividing the number of dollars by the number of men, it appears from the quotient and remainder, that each man can have $26, and still $13 will remain undivided.

We change $13 to cents, by annexing two ciphers, and then divide the cents by the number of men. From this quotient and remainder it appears, that each man will have 54 cents, and 4 cents will remain undivided.

70. If $7640 be divided equally among 61 men, what will each man receive?

71. 8 men received $230 for performing a piece of work. What was each one's share of the money?

72. An insurance office, whose stock was owned in 1000 shares, divided among the stock-holders, $1586. How much was paid on one share?

73. The expense of a village school, for 6 months, was $466.80; and it was paid in equal shares by 40 gentlemen. What was each one's share?

74. Add together $9.87, 50 cents, $705.30 and $390: subtract from this sum, 606 dollars and 7 cents multiply the remainder by 45: divide the product by 37. What is the quotient, and the remainder?

75. A shoe-maker paid $1.58 apiece for 10 calf-skins, and 22 cents a pound for 3 sides of sole leather, each side weighing 35 pounds. From this stock he made 48 pairs of shoes, which he sold at $1.75 a pair. What did he get for his work?

76. Suppose a man, whose income is $400 a year, should spend $3.90 a week, how much would he save in 2 years; there being 52 weeks in 1 year?

77. Suppose wheat to be worth $1.05 per bushel, and rye 70 cents per bushel: how many bushels of rye must be given for 550 bushels of wheat?

Questions to be answered Orally.

(1) What is Federal money? (2) State the denominations of Federal money. (3) State the number of mills in a cent, the number of cents in a dime, &c. (4) How many cents make a dollar? (5) By what short method do you find the number of cents in any number of dollars? (6) How do you distinguish the number of dollars, that there are in any number of cents? (7) In writing dollars and cents together, how many figures express the cents? (8) When the cents to be written with dollars are less than 10, what is to be done? (9) Suppose you are dividing dollars, and a remainder occurs, what is to be done, in order to divide the remainder?

SECTION 7.

TABLES OF COMPOUND NUMBERS.

ENGLISH MONEY is the national currency of England

4	farthings (qr.)	make 1 penny.	d
12	pence	make 1 shilling.	s
20	shillings	make 1 pound.	£

TROY WEIGHT is used in weighing gold and silver.

24	grains (gr.)	make 1 pennyweight.	dwt
20	pennyweights	make 1 ounce.	oz
12	ounces	make 1 pound.	lb

AVOIRDUPOIS WEIGHT is the common weight, used in weighing groceries, and all coarse commodities.

16	drams (dr.)	make 1 ounce.	oz
16	ounces	make 1 pound.	lb
28	pounds	make 1 quarter.	qr
4	quarters	make 1 hundred-weight.	cwt
20	hundred-weight	make 1 ton.	T

APOTHECARIES' WEIGHT is used for the purpose of compounding medicines, but not in selling them.

20	grains (gr.)	make 1 scruple.	℈
3	scruples	make 1 dram.	ʒ
8	drams	make 1 ounce.	℥
12	ounces	make 1 pound.	℔

CLOTH MEASURE is used in measuring cloth, lace, &c.

4	nails (na.)	make 1 quarter.	qr.
4	quarters	make 1 yard.	yd.
5	quarters	make 1 English ell.	E. e.
6	quarters	make 1 French ell.	Fr. e.
3	quarters	make 1 Flemish ell.	Fl. e

DRY MEASURE is used in measuring grain, salt, &c.

2	pints (pt.)	make 1 quart.	qt
8	quarts	make 1 peck.	pk.
4	pecks	make 1 bushel	bu.

WINE MEASURE is used by grocers and others, for measuring wine, oil, molasses, and most other liquids.

4	gills (gi.)	make 1 pint.	pt.
2	pints	make 1 quart.	qt
4	quarts	make 1 gallon.	gal
31½	gallons	make 1 barrel.	bl
42	gallons	make 1 tierce.	tier
63	gallons	make 1 hogshead.	hhd
84	gallons	make 1 puncheon.	pun
126	gallons	make 1 pipe or but.	p.
2	pipes, or 4 hhds.	make 1 ton.	T

BEER MEASURE is used in measuring malt liquors.

2	pints (pt.)	make 1 quart.	qt.
4	quarts	make 1 gallon.	gal.
9	gallons	make 1 firkin.	fir.
2	firkins	make 1 kilderkin.	kil.
2	kilderkins	make 1 barrel.	bl.

LONG MEASURE is applied to length, distance, &c.

3	barley-corns	make 1 inch.	in.
12	inches	make 1 foot.	ft.
3	feet	make 1 yard.	yd.
5½	yards or 16½ feet	make 1 rod or pole.	r.
40	rods	make 1 furlong.	fur
8	furlongs	make 1 mile.	m
3	miles	make 1 league.	l
$9\frac{2}{9}$	furlongs	make 1 geographical mile.	
60	geographical miles	make 1 degree.	deg
360	degrees	the earth's circumference.	

SQUARE MEASURE is used in measuring land, flooring, boards, tiling, and all other surfaces whatever.

144	inches	make 1 foot.	ft
9	feet	make 1 yard.	yd.
30¼	yards, or 272¼ ft.	make 1 rod or pole.	r.
40	rods	make 1 rood.	R.
4	roods	make 1 acre.	A.
640	acres	make 1 mile	ml.

CUBIC MEASURE is used in measuring solid bodies and in finding the capacity of rooms, boxes, &c.

1728	inches	make 1 foot	ft
40	feet of round timber	make 1 ton.	T
50	feet of hewn timber	make 1 ton.	T.
16	cubic feet	make 1 foot of wood.	ft. w.
8	feet of wood	make 1 cord of wood.	C

TIME is *naturally* divided into *days*, by the revolution of the earth upon its axis; and into *years*, by the revolution of the earth round the sun.

60	seconds	make 1 minute.	m.
60	minutes	make 1 hour.	h.
24	hours	make 1 day.	d.
365	days	make 1 year.	Y

The earth revolves round the sun once in 365 days, 5 hours, 48 minutes, and 48 seconds: this period is therefore a *Solar* year. In order to keep pace with the solar year in our reckoning, we make every fourth year to contain 366 days, and call it Leap year.

The year is divided into 12 months. The number of days in each month is commonly learned thus,—

30 days hath September,
April, June, and November;
February hath 28 alone,
And all the rest have 31.
Leap year comes 1 year in 4;
Then February hath 1 day more.'

'The 4th. 11th. 9th. and 6th.,
Have 30 days to each affixed,
And every other, 31,
Except the 2nd. month alone,
Which has but 28, in fine,
Till leap year gives it 29.'

Questions to be answered Orally.

(1) What is English money? (2) Recite the table. (3) How many shillings are there in 2 pounds? (4) How many pence in 2 shillings? (5) How many pence in 8 farthings? (6) How many pence in 36 farthings? (7) How many farthings in 6d. 3qr.?

(8) What is the use of Troy Weight? (9) Recite the table. (10) How many ounces in 2 pounds? (11) How many penny-weights in 4 ounces?

(12) What is the use of Avoirdupois Weight? (13) Recite the table. (14) How many ounces in 4 pounds? (15) How many hundred-weight in 3 tons? (16) How many hundred-weight in 24 quarters?

(17) How is Apothecaries' Weight used? (18) Recite the table. (19) How many scruples in 4 drams? (20) How many drams in 27 scruples?

(21) What is the use of Dry Measure? (22) Recite the table. (23) How many pecks in 12 bushels and 2 pecks? (24) How many bushels, and how many pecks over in 35 pecks?

(25) What is the use of Cloth Measure? (26) Recite the table. (27) In 5 yards how many quarters? (28) In 32 nails how many yards? (29) How many English ells in 14 quarters?

(30) To what is Wine Measure applied? (31) Recite the table. (32) In 2 gallons of vinegar how many quarts?—how many pints?—how many gills? (33) In 32 gills how many gallons?

(34) What is measured by Beer Measure? (35) Recite the table. (36) How many gallons are there in 6 firkins? (37) How many kilderkins in 19 firkins? (38) How many firkins in 1 barrel?

(39) What is Long Measure applied to? (40) Recite the table. (41) What number of inches are there in 1 yard? (42) How many feet in 38 inches? (43) In 6 furlongs how many miles?

(44) What is the use of Square Measure? (45) Recite the table. (46) How many square feet in 4 square yards? (47) How many rods in 2 roods? (48) How many acres in 20 roods?

(49) What is the use of Cubic Measure? (50) Recite the table. (51) How many cubic feet are there in 3 feet of wood? (52) In 48 feet of wood, how many cords of wood?

(53) How is time naturally divided? (54) Recite the table. (55) What is a Solar year? (56) How many months in a year? (57) Recite the lines that tell the number of days in each month.

SECTION 8.

REDUCTION OF COMPOUND NUMBERS.

Reduction is the operation of changing any quantity from its number in one denomination, to its number in another denomination. For instance, if we change an admeasurement from 2 feet to 24 inches, that is, if we find how many inches there are in 2 feet, the operation is called *reduction*. Again, if we change 24 inches to 2 feet, this operation is also called *reduction*.

ENGLISH MONEY.

1. How many farthings in £13 8s. 4d. 2qr.

£ s. d. qr.
13 8 4 2
20
268 shillings.
12
3220 pence.
4
Ans. 12882 farthings.

In this example, we consider, that there are 20 times as many shillings as pounds in any sum; therefore we multiply the 13 pounds by 20, and add the 8 shillings to the product. Then, since there are 12 times as many pence as there are shillings, we multiply the shillings by 12 and add the 4 pence to the product. Lastly, since there are 4 times as many farthings as pence, we multiply the pence by 4, and add 2 farthings to the product.

2. How many pounds in 12882 farthings?

qr.
4)12882
12)3220 2qr.
2|0)26|8 4d.
£13 8s.

£ s. d. qr.
Ans. 13 8 4 2

This example is the reverse of the first example. We here consider, that every 4 farthings make 1 penny; therefore, we find by division how many times 4 there are in the number of farthings: the quotient is pence, and the remainder is farthings. Then, since every 12 pence is 1 shilling, we divide the pence by 12; the quotient is shillings, and the remainder pence Lastly, since every 20 shillings make 1 pound, we divide the shillings by 20.

RULE FOR REDUCTION *When a greater denomination is to be reduced to a smaller, multiply the greater denomination, by that number which is required of the smaller, to make* ONE *of the greater; adding to the product so many of the smaller denomination as are expressed in the given sum. Perform a like operation on this product, and on each succeeding product.*

When a smaller denomination is to be reduced to a greater, divide the smaller denomination by that number which is required of the smaller, to make ONE *of the next greater: the quotient will be of the greater denomination, and the remainder will be of the same denomination with the dividend. Perform a like operation on this quotient, and on each succeeding quotient.*

3. How many farthings are there in 18s. 7d. 3qr.?
4. How many pounds are there in 9207 farthings?
5. How many pence are there in £5 0s. 11d.?
6. How many shillings are there in 647 farthings?
7. How many times 8 pence are there in £3 5s.?

TROY WEIGHT.

8. How many grains in 15lb. 11oz. 18dwt?

```
 lb.  oz.  dwt.
 15   11   18
 12
----
 191
  20
-----
 3838
   24
------
15352
7676
------
```

Ans. 92112 grains

9. How many pounds in 92112 grains?

```
        2|0)
 24)92112(383|8
    72    -------
   ---     191  18
   201
   192       12)191(15
   ---          12
    91          ---
    72           71
   ---           60
   192           --
   192           11
   ---
```

Ans. 15lb. 11oz. 18dwt.

10. How many penny-weights in 9lb. 13oz. 16dwt.?
11. How many pounds of silver in 829 penny-weights?
12. How many grains in 10oz. 19dwt. 12gr.?
3. How many pounds in 23641 grains?

AVOIRDUPOIS WEIGHT.

14. How many pounds are there in 1 ton?

15. How many drams are there in 7 tons, 3 quarters, 27 pounds, 5 ounces, and 13 drams?

16. How many tons are there in 31122 pounds?

17. What will 3 hundred-weight, 3 quarters, and 17 pounds of indigo cost, at $2.67 per pound?

18. A wealthy farmer wishes to put down 3T. 18cwt. 2qr. 8lb. of butter, in firkins, containing 50 pounds apiece. How many firkins will it require?

APOTHECARIES' WEIGHT.

19. How many scruples are there in 1 pound?

20. How many pounds are there in 1395 drams?

21. In 3℔ 9℥ 0ʒ 1℈ 10gr. of epecacuanha, how many doses are there; each dose containing 30gr.?

22. If it take 1 ounce of salts for a dose, what will 75 pounds amount to, at 4 cents a dose?

23. If it take 10 grains of calomel and 1 scruple of jalap for a dose, how many doses are there in 1℔ 1℥ 4ʒ of such a mixture?

CLOTH MEASURE.

24. How many nails are there in 1 English ell?

25. How many yards are there in 16240 nails?

26. In 320 yards, and 3 quarters, how many quarters? How many Flemish ells?

27. How many more nails are there in 75 English ells, than there are in 93 yards?

28. A shop-keeper sold cloth enough in one day to gain £6 1s. 8d., at a profit of 2 farthings on every yard. How much did he sell?

DRY MEASURE.

29. How many pints are there in 1 bushel?

30. How many pints are there in 58 bushels, 3 pecks, [illegible] quarts, and 1 pint?

31. How many bushels are there in 8240 quarts?

32. If 3 bushels and 2 pecks of corn will fill a barrel, what quantity of corn will 20 barrels hold?

33. Suppose it takes 3 pecks of salt to preserve a barrel of pork, how much salt would be necessary to preserve 351 barrels of pork?

WINE MEASURE.

34 How many gills are there in 1 hogshead?

35 How many hogsheads are there in 9084 pints?

36 If 3 tierces of molasses be sold at 12 cents a quart, what will the whole amount to?

37. What would 2 pipes of Madeira wine amount to, at 67 cents per quart?

38. A certain toper drank 1 gill of rum every forenoon, and 1 in the afternoon, for 6 years; in consequence of which, he died. How many hogsheads did he drink?

BEER MEASURE.

39. In 2 barrels and 1 firkin, how many pints?

40. In 6538 quarts, how many kilderkins?

41. How many bottles, holding 6 gills apiece, will be required, to bottle 6 barrels of porter?

42. A man retailed 4 barrels of ale, and received for it $69.12. At what price did he sell it a pint?

43. Suppose a retailer to sell 3 quarts of porter every day for 1 year, excepting 52 Sabbaths, how many barrels would he sell in the year?

LONG MEASURE.

44. In 35 yards, 2 feet, 10 inches, how many inches?

45. In 29578 barley-corns, how many yards?

46. In 16 leagues and 2 miles, how many rods?

47. How many geographical miles would a ship sail, in going round the globe?

48. In 2541 inches of wire, how many yards?

49. Suppose 7 inches of wire to make 1 link of a chain, and 4 links to measure 1 foot; how many yards of wire would make a chain 8 feet long?

SQUARE MEASURE.

To find the number of square inches, feet, or rods, in any surface which has four sides, and four equal angles, [corners,] multiply the length and breadth together.

50. How many square inches are there in a slate, that is 13 inches long, and 8 inches wide?

51. How many square rods are there in a field 28 rods long, and 16 rods wide? How many acres?

52. How many square yards of carpeting will cover a floor 36 feet long, and 18 feet wide?

CUBIC MEASURE.

A *cube* may be illustrated by a solid block, having 6 equal sides. Let us suppose we have before us a number of small blocks, representing cubic inches. If we lay 144 of these blocks together upon the table, they will cover a square foot. Then, if we cover this layer of blocks with another layer, and thus continue till we have piled up 12 layers, the pile will contain 12 times 144 cubic inches, or 1 cubic foot. Therefore, *to find the cubical contents of any thing, multiply its length, and breadth, and depth together.*

53. How many cubic inches are there in a brick, that is 8 inches long, 4 inches wide, and 2 inches thick?

54. How many cubic feet in a box, that is 25 inches long, 20 inches broad, and 11 inches deep?

55. How many cubic inches in 1 ton of hewn timber?

56. How many cubic feet in a pile of wood 15 feet long, 4 feet wide, and 5 feet high? How many feet of wood? How many cords?

57. How many cubic feet in a cord of wood?

TIME.

58. How many seconds are there in a common year? How many in a leap year? How many in a solar year?

59. How many minutes are there in 57 days?

60. If your pulse beat 73 times in a minute, how many times will they beat in the month of January?

61. How many years and days, from the 1st day of January, 1830, to the 1st day of October, 1834?

Questions to be answered Orally.

(1) What is meant by *reduction*? (2) How do you reduce shillings to pence? (3) How do you reduce pence to shillings? (4) How do you reduce Avoirdupois ounces to pounds?—Why? (5) How do you reduce pounds to ounces?—Why? (6) How do you reduce yards to nails? (7) How do you reduce nails to yards? (8) Recite the general rule for reduction.

SECTION 9.

COMPOUND ADDITION.

ENGLISH MONEY.

1. What is the whole sum of £13 7s. 10d. 2qr., £4 12s 0d. 1qr., £60 0s. 11d. 3qr., 19s. 0d. 2qr., £116, £7 10s. 10d., 1s. 8d. 3qr., and £76?

£	s.	d.	qr.
13	7	10	2
4	12	0	1
60	0	11	3
	19	0	2
116	0	0	0
7	10	10	0
	1	8	3
76	0	0	0
278	12	5	3

The sum of the column of farthings is 11; equal to 2d. 3qr. We write the 3qr. and add the 2d. to the column of pence. The sum of the pence is 41; equal to 3s. 5d. We write the 5d. and add the 3s. to the column of shillings. The sum of the shillings is 52; equal to £2 12s. We write the 12s. and add the £2 to the column of pounds.

RULE FOR COMPOUND ADDITION. *Write the numbers so that each denomination shall stand in a separate column. Add the numbers of the lowest denomination together, and divide their sum by that number which is required of this denomination to make 1 of the next higher: write the remainder under the column added, and carry the quotient to the next column. Thus proceed with every denomination.*

2. What is the sum of £4 18s. 9d., £100 7s. 0d. 1qr., 16s. 4d., 3s. 6d. 2qr., £20, and £9 7s. 4d.?

3. What is the sum of 11s. 0d. 3qr., £33 2s. 6d., 8s. 7d. 1qr., £450, £9 17s. 8d. 3qr., and £37 9s.?

4. A man in London paid for a hat, £1 18s. 6d.; for a coat, £9 8s. 4d., for a vest, £1 10s.; for pantaloons £3; for boots, £1 2s. What did the suit cost?

TROY WEIGHT.

5. Add together these quantities of silver. 4lb. 9oz 16dwt., 10oz. 1dwt. 22gr., and 3lb. 4oz. 0dwt. 6gr.

6. Add together 11oz. 15dwt. 18gr., 2lb. 10oz. 18dwt. 23gr., 9lb. 0oz. 17dwt. 3gr., and 5oz. 12dwt.

AVOIRDUPOIS WEIGHT.

7. Add together 14T. 10cwt. 2qr. 23lb. 4oz., 27T 4cwt. 2qr. 24lb. 14oz., and 3qr. 0lb. 15oz. 11dr.

8. Add together 16cwt. 1qr. 11lb. 6oz. 16cwt. 2qr 20lb., 5T. 0cwt. 3qr. 5lb. 13oz. 2dr., and 2T.

APOTHECARIES' WEIGHT.

9. What is the weight of a mixture containing 5℔ 10℥ 5ʒ 1℈ 8gr., 6ʒ 2℈, 5ʒ 1℈ 18gr., and 2℔ 4℥?

10. What is the weight of a mixture containing 1℔ 3℥ 1ʒ 2℈, 7℥ 5ʒ 1℈ 15gr., and 4℔ 0℥ 6ʒ?

CLOTH MEASURE.

11. Add together 19yd. 2qr. 3na., 14yd. 2qr. 1na., 32yd. 0qr. 1na., 2qr. 2na., and 57yd. 3qr. 2na.

12. Add together 15E.e. 4qr. 2na., 6E.e. 3qr. 1na., 45E.e. 3qr. 3na., 230E.e., and 4E.e. 4qr.

DRY MEASURE.

13. Add together 25bu. 2pk. 5qt., 240bu. 0pk. 6qt., 316bu. 3pk. 7qt. 1pt., and 650bu. 2pk. 5qt.

14. Add together 635bu. 0pk. 3qt., 247bu. 3pk. 0qt 1pt., 2bu. 3pk. 6qt., 56bu., and 31bu. 0pk. 2qt.

WINE MEASURE.

15. How many hogsheads are 12hhd. 42gal. 3qt 1pt., 548hhd. 62gal. 3qt., and 8hhd. 9gal. 1qt.?

16. How many tons are 1T. 1p. 116gal. 3qt., 1p 48gal., 5T. 1p. 86gal. 3qt., 102gal., and 4T.?

BEER MEASURE.

17. Add together 5bl. 1kil. 1fir. 8gal. 3qt., 1fir. 5gal 2qt. 1pt., 16bl. 0kil. 0fir. 4gal., and 25bl. 1kil.

18. Add together 1fir. 7gal. 3qt., 24bl. 0kil. 1fir. 6gal. 2qt. 1pt., and 20bl. 1kil. 1fir. 4gal.

LONG MEASURE.

19. How many yards are 45yd. 2ft. 11in., 13yd 0ft. 9in., 1ft. 10in., and 20yd. 1ft. 8in. 2b.c.?

20. How many miles are 10m. 0fur. 36rd., 58m. 7fur. 13rd., 38rd., 16m. 4fur. 21rd., and 6fur.?

SQUARE MEASURE.

21. How many yards are 36yd. 7ft. 126in., 3yd. 6ft., 130in., 71yd. 5ft. 140in., and 10yd. 4ft. 21in.?

22. How many acres are 34A. 3R. 32rd., 86A. 0R. 21rd., 381A. 2R., and 46A. 1R. 25rd.?

CUBIC MEASURE.

23. How much hewn timber is 7T. 45ft. 1712in., 8T. 39ft. 1698in., and 10T. 29ft. 800in.?

24. How many cords of wood are 9C. 7ft.w. 15c.ft., 4C. 6ft.w. 12c.ft., and 14C. 7ft.w. 11c.ft.?

TIME.

25. Add together 2Y. 250d. 18h. 51m. 15s., 1Y. 18d. 7h. 0m. 55s., and 240d. 0h. 37m. 29s.?

26. Add together 4Y. 141d. 10h. 0m. 5s., 12Y 194d. 20h. 49m., and 2Y. 280d. 0h. 55m. 38s.

SECTION 10.

COMPOUND SUBTRACTION.

ENGLISH MONEY.

1. An English merchant gave £9176 16s. 8d. 1qr. for a ship's cargo, and then sold the same cargo for £9607 4s. 5d. 3qr. How much did he gain?

£	s.	d.	qr.
9607	4	5	3
9176	16	8	1
430	7	9	2

To subtract the 8d., we unite 1 of the 4s. with the 5d., making 17d., and take 8 from 17. Then, having used 1 of the 4s., we unite £1 with 3s., making 23s., and take 16 from 23.

RULE FOR COMPOUND SUBTRACTION. *Write the several denominations of the smaller quantity under the same denominations of the greater quantity: then, begin with the lowest denomination, and perform subtraction on each denomination separately. Whenever a number expressing a denomination in the upper line is smaller than the number under it, increase the upper number by as many as make* 1 *of the next higher denomination, and consider the number of the next higher denomination in the upper line, to be* 1 *less than it stands.*

2. Subtract £4 11s. 6d. from £61 14s. 5d.

3. If an English servant receive £1 per month, and spend 13s. 4d. 3qr. per month, what does he lay up?

4. Subtract £75 18s. 7d. 1qr. from £856 14s. 9d

TROY WEIGHT.

5. Subtract 1lb.0 oz. 19dwt. from 2lb. 11oz. 9dwt.

6. A silver-smith having 4lb. 3oz. of silver, worked up 11oz. 14dwt. of it. How much had he left?

AVOIRDUPOIS WEIGHT.

7. From 8T. 12cwt. 1qr. 17lb. take 7cwt. 3qr. 2lb.

8. A farmer laid in 68T. of hay, and used 55T. 14cwt. in wintering his stock. How much had he left?

APOTHECARIES' WEIGHT.

9. From 1℔ 8℥ 5ʒ take 7℥ 7ʒ 2℈ 16gr.

10. A mixture weighing 3℥ 2℈, contains 8℈ of jalap, and the rest is rhubarb. How much rhubarb?

CLOTH MEASURE.

11. Subtract 3qr. 2na. from 46yd. 1qr. 1na.

12. If 7yd. 2qr. 2na. be cut from a piece of cloth containing 46yd. 1qr. 3na., how much will be left?

DRY MEASURE.

13. Subtract 4bu. 1pk. 7qt. 1pt. from 87bu.

14. A farmer raised 100bu. of corn, and sold 46bu. 3pk. of it. How much had he remaining?

WINE MEASURE.

15. From 2hhd. 15gal. take 1hhd. 20gal. 3qt.

16. If from a tierce of molasses 7gal. 2qt. 1pt. leak out, how much will remain in the tierce?

BEER MEASURE.

17. From 4bl. 1kil. 1fir. take 1fir. 7gal. 3qt.

18. A brewer having 26bl. 1kil. of beer, sold 12bl 0kil. 1fir. How much had he remaining?

LONG MEASURE.

19. Subtract 4yd. 2ft. 9in. from 5yd. 1ft. 10in.

20. John rode 16m. 5fur., and Henry rode 20m. 1fur 8rd. How much further did H. ride, than J.?

SQUARE MEASURE.

21. A farmer owning 94A. of land, sold off a piece, 48 rods long, and 20 rods wide. How many acres had he remaining? (See Square Measure, page 137.)

CUBIC MEASURE.

22. If a piece of timber 9 feet long, 2 feet wide, and 1 foot thick, be taken from 2T. 14ft. of hewn timber, how much will be left? (See page 138.)

TIME.

23 Subtract 3Y. 45d. 6h. 50m. from 5Y. 14d. 12h.

24 A ship went to India and returned, in 321d. 7h. How much less than a year was she in the voyage?

Section 11.

COMPOUND MULTIPLICATION.

ENGLISH MONEY.

1. What is the value of 8 yards of English broad cloth, at £2 0s. 5d. 3qr. per yard?

£	s.	d.	qr.
2	0	5	3
			8
16	3	10	0

8 times 3qr. are 24qr., equal to 6d. 8 times 5d. are 40d., and 6 we carry are 46d., equal to 3s. 10d. 8 times 0s. is 0s., but we carry 3s. 8 times £2 are £16.

RULE FOR COMPOUND MULTIPLICATION. ***Begin with the lowest denomination, and multiply each denomination separately; divide each product by the number which is required of its own denomination to make 1 of the next higher; write the remainder under the denomination multiplied, and carry the quotient to the product of the next higher denomination.***

2. Multiply £529 13s. 10d. 3qr. by 5.

3. What is the value of 7 tons of hemp, at £50 18s. 10d. per ton.

4. Multiply £7529 18s. 0d. 1qr. by 6.

5. Multiply £250 16s. 11d. by 24.

In examples like this, it is most convenient to multiply by *factors* of the multiplier.

6. Multiply £57 8s. 10d. 2qr. by 45.

7. What cost 34 cows, at £3 9s. 6d. apiece?

Here find the price of 32 cows by the factors of 32 and to the product add the price of 2 cows.

8. Multiply £1746 14s. 10d. 2qr. by 46.

9 What is the value of 29 yards of Irish linen, at 7s. 9d. 2qr. per yard.

10 Multiply 18s. 4d. by 83.

TROY WEIGHT.

11. Multiply 14lb. 0oz. 8dwt. 11gr. by 7.

12. What is the weight of 11 Federal dollars; the weight of 1 dollar being 17dwt. 8gr.?

AVOIRDUPOIS WEIGHT.

13. Multiply 7T. 12cwt. 1qr. 14lb. by 8.

14. What is the weight of 25 hogsheads of fish; each hogshead containing 5cwt. 3qr. 15lb.?

CLOTH MEASURE.

15. Multiply 29yd. 2qt. 3na. by 9.

16. How many yards of broad-cloth are there in 35 pieces; each piece containing 47yd. 1qr. 2na?

DRY MEASURE.

17. Multiply 33bu. 3pk. 6qt. 1pt. by 5.

18. How many bushels of corn are there in 18 bags, each bag containing 2bu. 2pk. 5qt. 1pt.?

WINE MEASURE.

19. Multiply 1p. 1hhd. 52gal. 2qt. 1pt. by 4.

20. How many hogsheads of wine are there in 13 casks; each cask containing 49gal. 3qt.?

BEER MEASURE.

21. Multiply 6bl. 1kil. 0fir. 6gal. 2qt. 1pt. by 7.

22. If 1 man drink 2gal. 3qt. 1pt. of beer in a week, how much will 38 men drink in a week?

LONG MEASURE.

23. Multiply 5lea. 2m. 6fur. 36rd. by 8.

24. If a man travel 55m. 5fur. 17rd. a day, for 18 days, how many miles will he have travelled.

SQUARE MEASURE.

25. Multiply 36A. 3R. 27rd. by 6.

26. How many square yards are there in 14 rolls of carpeting; each roll containing 52sq. yd. 3sq. ft?

CUBIC MEASURE.

27. Multiply 1T. 34ft. 1200in. of round timber by 3.

28. There are 4 piles of wood; each containing 3C. 6ft.w. 12c.ft. How much wood is there in all.

TIME.

29. Multiply 4Y. 255d. 16h. by 9.

30. If a ship alter her latitude 1 degree in sailing 16h 40m., in what time will she alter it 15 degrees?

SECTION 12.

COMPOUND DIVISION.

1. If £2047 13s. 9d. be divided equally among 6 men, how much will each man receive?

```
  £     s   d.
6)2047  13  9
  ------------
  341   5   7  2qr.
  ------------
```

We divide the pounds, and there remains £1. This £1 we reduce to shillings, and unite it with the 13s. making 33s. We divide the 33s., reduce the remainder to pence, and proceed as before.

2. If 19s. 11d. 3qr. be divided equally among 3 men, how much will each man receive?

3. Divide £16 14s. 10d. 3qr. equally among 5 men

4. Divide £3 0s. 8d. equally among 7 men.

5. Divide £59 18s. 4d. equally among 25 men.

```
    £   s.  d.  £  s. d.
25)59  18  4 (2  7  11
   50
   --
    9
   20
   ---
25)198(7s.
   175
   ---
    23
    12
   ---
25)280(11d.
   25
   ---
    30
    25
    --
     5d. remaining.
```

This operation is in *long* division. We first divide the pounds: the quotient is £2, and the remainder, £9. We then reduce the £9 to shillings, adding in the 18s., and divide this sum [198s.] as before: the quotient is 7s. and the remainder, 23s. We then reduce the 23s. to pence, adding in the 4d., and divide this sum as before. 5d. remain undivided. Observe, that, in every instance, the quotient and remainder are of the same denomination with the dividend.

RULE FOR COMPOUND DIVISION. *Divide each denomination separately, beginning with the highest. Whenever a remainder occurs, reduce it to the next lower denomination, add it to the number expressed in the lower denomination, and divide it therewith.*

6. Divide £460 5s. 10d. equally among 37 men.

7. If 15cwt. 3qr. 18lb. of flour be packed equally in 9 barrels, how much will each barrel contain?

8. If it take 15 yards of cloth to make 6 coats, how much does it take to make 1 coat?

9. If an army consume 492bu. 0pk. 6qt. of wheat in 42 days, how much does it consume in 1 day?

10. Divide 3qt. 1pt. of wine equally among 7 men.

11. If 30hhd. 13gal. 2qt. of cider will fill 18 casks of equal size, how much does each cask hold?

12. Divide 58m. 2fur. 32rd. into 8 equal distances.

13. Suppose a man is to travel 339m. 4fur. 20rd. in 6 days; what distance must he travel each day?

14. If a field containing 22A. 2R. 12rd. be divided into 4 equal lots, what will each lot contain?

15. Suppose a township, containing 17715 acres of land, should be divided into 80 equal farms, how many acres would each farm contain?

16. Suppose a rail-way car to perform 4 trips in 5d 16h. 9m., in what time does it perform 1 trip?

Questions to be answered Orally.

(1) Which of these numbers is a compound number,—£356, or £2 18s.? (2) Why is it called a compound number? (3) Recite the rule for addition of compound numbers. (4) Suppose the sum of a column of numbers expressing furlongs to be 37; what must be written under the column, and what must be carried to the next column?—Why? (5) Recite the rule for subtraction of compound numbers. (6) Recite the rule for multiplication of compound numbers. (7) Recite the rule for division of compound numbers.

CHAP. VI.

FRACTIONS.

Fractions have been exemplified in page 44, and the mode of expressing them has been defined in page 74.

A *proper* fraction expresses a quantity, less than a unit. Therefore, the numerator of a proper fraction, must be less than the denominator: for example, $\frac{2}{7}$.

An *improper* fraction expresses a quantity, equal to a unit, or greater than a unit: therefore its numerator must equal, or exceed its denominator: thus, $\frac{3}{3}$. $\frac{9}{4}$.

A *compound* fraction is a fraction of a fraction—a part of a part of a unit: for example, $\frac{2}{3}$ of $\frac{1}{5}$.

NOTE. The written operations required in the several sections of this chapter, correspond with the mental operations involved in sections of the same number, in chapter VI, Oral Arithmetic. Learners will be enabled to perceive the written process to be adopted, by recurring to the oral examples.

Section 1.

1. What is the sum of $\frac{3}{12}$ and $\frac{5}{12}$ and $\frac{2}{12}$?

$$\begin{array}{c}\frac{3}{12}\\ \frac{5}{12}\\ \frac{2}{12}\\ \hline \frac{10}{12}\end{array}$$

These fractions have a *common denominator;* that is, they all have the same denominator. We add the numerators only, and under the sum of the numerators, place the common denominator.

2. What is the sum of $\frac{2}{8}$ and $\frac{1}{8}$ and $\frac{3}{8}$ and $\frac{1}{8}$?

3. How much is $\frac{5}{19}$ and $\frac{4}{19}$ and $\frac{2}{19}$ and $\frac{3}{19}$ and $\frac{1}{19}$?

4. A man paid $\frac{4}{16}$ of a dollar for breakfast, $\frac{5}{16}$ of a dollar for dinner, and $\frac{4}{16}$ of a dollar for supper. What part of a dollar did he spend?

5. How much is $\frac{7}{25}$ and $\frac{3}{25}$ and $\frac{3}{25}$ and $\frac{6}{25}$ and $\frac{2}{25}$?

6. A merchant sold $\frac{12}{18}$ of a ship to one man, and $\frac{3}{18}$ to another. What part of the ship did he sell?

7. Add together $\frac{10}{74}$ and $\frac{9}{74}$ and $\frac{15}{74}$ and $\frac{18}{74}$ and $\frac{12}{74}$?

8. How much is $\frac{3}{9}$ and $\frac{1}{9}$ and $\frac{2}{9}$ and $\frac{3}{9}$?

9. How much is $\frac{1}{114}$ and $\frac{16}{114}$ and $\frac{40}{114}$ and $\frac{25}{114}$?

SECTION 2.

Write upon the slate, the several fractions required in the following examples.

1. If you divide a bushel of corn into 8 equal parts, and then put 6 of the parts into a sack, what fraction of a bushel will there be in the sack?

2. If an acre of land be divided into 20 equal lots, and 14 of the lots be enclosed by a fence, what fraction of an acre will there be in the enclosure?

3. Suppose any thing to be divided into 45 equal parts; what fraction will express 26 of the parts?

4. Suppose 1 dollar to be divided into 100 equal parts; what fraction will express one of the parts? 2 of the parts? 6 parts? 25 parts? 99 parts?

SECTION 3.

1. If $\frac{6}{15}$ be subtracted from $\frac{11}{15}$, what will remain?

$$\begin{array}{c} \frac{11}{15} \\ \frac{6}{15} \\ \hline \frac{5}{15} \end{array}$$

Both of these numerators express *fifteenths*; therefore we merely subtract one numerator from the other, and under the remainder, place the denominator.

2. If $\frac{4}{10}$ be subtracted from $\frac{9}{10}$, what will remain?

3. What is the difference between $\frac{5}{9}$ and $\frac{8}{9}$?

4. If $\frac{11}{19}$ be subtracted from $\frac{16}{19}$ what will remain?

5. What is the difference between $\frac{8}{47}$ and $\frac{26}{47}$?

6. A farmer divided a ton of hay into 20 equal parts, and gave 14 parts to his cows, and the rest to his sheep. What fraction of a ton did the sheep get?

7. Subtract $\frac{6}{8}$ from 1,—that is, subtract $\frac{6}{8}$ from the number of eighths that there are in a whole one.

8. Subtract $\frac{7}{18}$ from a whole 1.

9. What is the difference between $\frac{75}{124}$, and 1?

10. Subtract $\frac{246}{500}$ from a whole 1.

11. A merchant owning a ship, sold $\frac{15}{34}$ of her to one man, $\frac{6}{34}$ to another, and $\frac{4}{34}$ to another. What part of the ship did he still own?

12. A boy having 1 dollar, paid away $\frac{59}{100}$ of it, and lost $\frac{10}{100}$. What fraction of a dollar had he left?

13. Subtract $\frac{244}{530}$ from a whole 1.

RELATIONS OF NUMBERS.

SECTION 4.

We frequently have occasion to view one number as a certain part of another number; and thus we notice the *relation* that exists between the two numbers. In order to state what part one number is, of another, we make the number which is the *part* a numerator, and the other number a denominator.

State the fractions, which answer to the following examples, upon the slate.

1. What part of 5 cents is 1 cent? is 3 cents?

2. What part of 10 is 1? is 2? is 5? is 9?

3. What part of £1 or 20 shillings, is 1 shilling? is 6 shillings? is 14 shillings?

4. What part of 35 is 1? is 8? is 11? is 34?

5. What part of $1 or 100 cents, is 1 cent? is 2 cents? is 9 cents? is 46 cents? is 94 cents?

6. What part of 6 pence is 1 penny? is 5 pence?

7. What part of 1 shilling is 1 penny? is 7 pence?

8. What part of 1 peck is 1 quart? is 7 quarts?

9. What part of 1 hogshead is 1 gallon? is 18 gals.?

10. If $\frac{1}{63}$ of a hogshead of wine be worth $1, what is $\frac{12}{63}$ of a hhd. worth? What is 1hhd. worth?

11. What part of 1 year is 1 day? is 10 days? is 40 days? is 100 days? is 275 days?

12. If a man spend $1, in $\frac{1}{365}$ of a year, how much will he spend in $\frac{14}{365}$ of a year? in $\frac{120}{365}$ of a year? How much will he spend in 1 year?

13. What part of 2016 is 1? is 84? is 759?

SECTION 5.

1. Suppose $\frac{1}{2}$ of a ship to be worth $4703; what is the whole ship worth?

2. 4703 is $\frac{1}{2}$ of what number?

3. If $\frac{1}{3}$ of an acre of land produce 71 bushels of potatoes, how many bushels will 1 acre produce?

4. 71 is $\frac{1}{3}$ of what number?

5. 875 is $\frac{1}{4}$ of what number?

6. 1900 is $\frac{1}{6}$ of what number?

7. If 230 men will lay $\frac{1}{6}$ of a mile of rail-way a week, how many men will it take to lay 1 mile in a week?

8. 230 is $\frac{1}{6}$ of what number?

9. 44 is $\frac{1}{7}$ of what number?

10. 6902 is $\frac{1}{8}$ of what number?

11. If $\frac{1}{11}$ of a pound of silver be worth $1.09, what is 1 pound of silver worth?

12. If a ship sail 17 miles in $\frac{1}{24}$ of a day, what distance would she sail in the whole day?

13. 204 is $\frac{1}{55}$ of what number?

14. If $\frac{1}{120}$ of a pipe of wine be worth $1.15, what is the whole pipe of wine worth?

15. Suppose $\frac{1}{9}$ of the sugar in a hogshead to weigh 1cwt. 2qr. 12lb.; what does the whole weigh?

Section 6.

1. If 1 acre of land will produce 126 bushels of potatoes, how many bushels will $\frac{1}{2}$ of an acre produce?

2. What is $\frac{1}{2}$ of 126?

3. Suppose 38406 needles can be made from a bar of steel; how many can be made from $\frac{1}{3}$ of the bar?

4. What is $\frac{1}{3}$ of 38406?

5. If 1 dollar will pay for 316 quills, what number of quills will $\frac{1}{4}$ of a dollar pay for?

6. If you eat 1095 meals in 1 year, what number of meals do you eat in $\frac{1}{3}$ of a year?

7. What number of cubic inches are there in $\frac{1}{6}$ of a cubic foot? (See Cubic Measure, page 132.)

8. If 1 week's board cost $3.64, what does $\frac{1}{7}$ of a week's board cost?

9. Suppose a packet ship to be worth $17841.50: what is $\frac{1}{10}$ of her worth?

10. A man, having $205.12, paid $\frac{1}{16}$ of his money for a piece of land. What was the price of the land?

11. A man gave $2568 for a house, and then paid $\frac{1}{24}$ part as much for having it repaired. For how much must he sell the house, in order to lose nothing?

12. What is $\frac{1}{75}$ of 1800?

13. Suppose a piece of cloth to contain 60yd. 2qr how much cloth is there in $\frac{1}{3}$ of the piece?

SECTION 7.

1. Suppose that 12 men are to pay a debt of $420 n equal shares; what must 1 man pay?

Solution. 1 man is $\frac{1}{12}$ of 12 men; therefore 1 man must pay $\frac{1}{12}$ of $420. $\frac{1}{12}$ of 420 is—

2. If a prize of $3936 be divided equally among 5 men, what part of the money will 1 man receive? How many dollars will 1 man receive?

3. 27 men own 864 acres of land together. What part of 864 acres does 1 man own? What number of acres does 1 man own?

4. If $135.45 will pay for 1hhd. of wine, what part of the money would pay for 1 gallon? What would be the price of 1 gallon?

5. If 170 acres of land produce 6630 bushels of corn, what part of 6630 bushels does 1 acre produce? How many bushels does 1 acre produce?

6. If 6 yards of broad-cloth be worth £11 11s. 9d. what part of the money is 1 yard worth? What is the value of 1 yard, in pounds, shillings, &c.?

7. A black-smith paid $63 for 15 tons of coal. What did the coal cost him per ton?

SECTION 8.

1. A man purchased a farm for $5642, and paid $\frac{4}{7}$ of the price in cash, and gave his note for the remainder. How many dollars did he pay down?

Direction. First find $\frac{1}{7}$ of $5642, by dividing this sum by the denominator of the fraction; then find 4-sevenths, by multiplying the quotient by the numerator

2. What is $\frac{2}{3}$ of 1905?

3. If an acre of land will produce 14870 ears of corn, how many ears will $\frac{4}{5}$ of an acre produce?

4. What is $\frac{3}{8}$ of 19064?

5. Suppose an acre of land to be worth $48.16; what is the value of $\frac{3}{4}$ of an acre of the same land?

6. If 1 dollar will pay for 270 quills, what number o quills will $\frac{2}{10}$ of a dollar pay for?

7. If 72 gallons of wine leak from a pipe in 1 day how many gallons leak out in $\frac{9}{24}$ of a day?

8. Suppose a hogshead of sugar to be worth £20 4s 3d.; what is the value of $\frac{7}{9}$ of the sugar?

9. What is $\frac{18}{45}$ of 4720?

In the several foregoing examples in this section, the learner has probably divided the given number by the denominator of the fraction, and multiplied the quotient by the numerator. It is, however, sometimes more convenient, to multiply the given number by the numerator, and divide the product by the denominator.

10. What is $\frac{3}{4}$ of 32? (Here are the two methods.)

First Method.	*Second Method.*
4)32	32
8 is $\frac{1}{4}$ of 32.	3
3	4)96 is 3 times 32.
24 is 3 times $\frac{1}{4}$ of 32, which is $\frac{3}{4}$ of 32.	24 is $\frac{1}{4}$ of 3 times 32, which is $\frac{3}{4}$ of 32.

We may see why these two methods of operation produce the same result, in the following illustration. Here is $\frac{3}{4}$ of 32 units arranged in one line, and $\frac{1}{4}$ of 3 times 32 units arranged in three lines. The number of units [●] in the two arrangements is the same.

●●●●●●●● ●●●●●●●● ●●●●●●●● ○○○○○○○○

●●●●●●●● ○○○○○○○○ ○○○○○○○○ ○○○○○○○○
●●●●●●●● ○○○○○○○○ ○○○○○○○○ ○○○○○○○○
●●●●●●●● ○○○○○○○○ ○○○○○○○○ ○○○○○○○○

11. Find $\frac{7}{12}$ of 60156, by each of the above methods.

12. Find $\frac{2}{571}$ of 10849, by the second method.

13. A laborer worked $\frac{4}{5}$ of a year, at 92 cents per day. What did his wages amount to?

14. In $\frac{11}{12}$ of a pipe of wine, how many gallons?

15. What is $\frac{6}{100}$ of $1491?

After multiplying by 6 and dividing by 100, reduce the remainder to cents, and divide the cents.

16. A borrowed of B, $758, promising to pay it in one year; and, in addition thereto, he agreed to pay a sum, equal to $\frac{6}{100}$ of the sum borrowed, for the use of the money. How much must B receive?

What is $\frac{6}{100}$ of $28?

SECTION 9.

1. If $686.56 should be divided equally among 8 men, what part of the money,—and what number of dollars and cents, would 3 men receive?

2. Suppose that $33 will pay for 198 yards of cloth, what part of 198 yards,—and how many yards can be bought for $14?

3. If 15 acres of land produce 283bu. 0pk. 4qt. of wheat, what part of this quantity,—and how many bushels will 9 acres produce?

4. If 540 barrels of flour will supply an army for 30 days, how many bushels will supply it for 19 days?

Solution. 19 days are $\frac{19}{30}$ of 30 days; therefore the army will consume $\frac{19}{30}$ of 540 barrels.

5. If a man can build 256 rods of fence, in 60 days, how many rods can he build in 45 days?

6. If 72 tons of hemp cost $13680, what will 20 tons cost, at the same rate?

7. If it take a man 31 days to travel 1178 miles, how many miles can he travel in 25 days?

8. If 24 English watches are worth £108 18s., what is the value of 7 watches of the same kind?

SECTION 10.

1. If 16 men can fell 208 trees in a day, how many trees can 35 men fell in the same time?

2. What is 35 times $\frac{1}{16}$ of 208?

3. If 10 barrels of flour cost $59.30, how much will 33 barrels cost, at the same price per barrel?

4. What is 33 times $\frac{1}{10}$ of $59.30?

5. If 64 soldiers eat 448 pounds of beef in a week, how many pounds will 250 soldiers eat in a week?

6. What is 250 times $\frac{1}{64}$ of 448?

7. If 12 gallons of linseed oil be sold for $13.44, what should be the price of 52 gallons of linseed oil?

8. What is 52 times $\frac{1}{12}$ of $13.44?

9. If a man earn $91.70 in 7 months, how much can he earn in 2 years?

10. If 48 pounds of feathers can be bought for $16, how many pounds can be bought for $25?

SECTION 11.

1. If $\frac{2}{5}$ of an acre of land will produce 28 bushels of potatoes, how many bushels will $\frac{1}{5}$ of an acre produce? How many bushels will 1 acre produce?

2. If $\frac{3}{8}$ of a hogshead of sugar be worth $22.50, what is $\frac{1}{8}$ of it worth? What is the whole worth?

3. $22.50 is $\frac{3}{8}$ of what sum of money?

4. Suppose a ship to sail 105 miles in $\frac{5}{12}$ of a day; what distance will the ship sail in $\frac{1}{12}$ of a day? What distance will she sail in the whole day?

5. 105 is $\frac{5}{12}$ of what number?

6. If $\frac{4}{17}$ of a chest of tea be worth $23, what is $\frac{1}{17}$ of it worth? What is the whole of it worth?

7. $23 is $\frac{4}{17}$ of what sum of money?

8. If $\frac{6}{7}$ of a bag of coffee be worth $38.46, what is the whole bag of coffee worth?

9. Suppose a rail-way car to run 198 miles, in $\frac{9}{24}$ of a day; what distance will it run in 1 day?

10. If 192 men will perform $\frac{8}{9}$ of a certain piece of work in a week, what number of men will it take, to perform the whole of the work in a week?

11. 192 is $\frac{8}{9}$ of what number?

12. A man purchased a farm, and after he had paid $\frac{6}{20}$ of the price, he still owed $1288. What must have been the price of the farm?

13. A trader purchased a pipe of wine, and after $\frac{1}{6}$ of it had leaked out, he sold the remainder at $1.15 per gallon. How much did it amount to?

Questions to be answered Orally.

(1) What is meant by a *common denominator* of two or more fractions? (2) How do you add fractions, that have a common denominator? (3) How do you subtract one fraction from another; the two fractions having a common denominator? (4) When a certain fractional part of a number is known, how do you find the whole of the number? (5) When the whole of a number is known, how do you find any certain fractional part of it?

SECTION 12.

REVIEW.

1. (§ 1.) If you should pay $\frac{17}{100}$ of a dollar for a quire of paper, $\frac{20}{100}$ of a dollar for a slate, and $\frac{46}{100}$ for a book, what fraction of a dollar would you spend?

2. (§ 2.) If a ton of hay be rolled up in 20 equal heaps, what fraction of a ton will 14 heaps be?

3. (§ 3.) Suppose a young man to lay out $\frac{1}{1}\frac{6}{9}$ of his money for a farm; what part of his money has he left?

4. (§ 4.) Suppose a school to be allowed 15 minutes for recess; what fraction of an hour is the recess?

5. (§ 5.) $\frac{1}{20}$ of an ounce, or 1dwt. of pure gold, is sufficient to gild a silver wire, 65 miles in length. What length of wire may be gilded with 1 ounce?

6. (§ 6.) If a man's income be $198 a year, how much is his income for $\frac{1}{12}$ of a year, or 1 month?

7. (§ 7.) If $14 will pay for 70 books, what part of 70 books,—and how many books, will $1 buy?

8. (§ 8.) If a man's income be $803 a year, how much is his income for $\frac{30}{365}$ of a year, or 30 days?

9. (§ 9.) Suppose $93.66 to be paid for 14 yards of broad-cloth; what part of the money does 6 yards cost? How many dollars do 6 yards cost?

10. (§ 10.) If 11 barrels of flour are worth $59.07, what is the value of 25 barrels, at the same rate?

11. (§ 11.) If 18 shillings be given for $\frac{6}{13}$ of a hundredweight of fish, what must be given for 1 cwt.?

FRACTIONS AND RELATIONS.

SECTION 13.

1. Suppose you can read 12 pages in an hour; how many hours will it take you to read 160 pages?

$$
\begin{array}{r}
12)160(13\frac{4}{12} \\
\underline{12}\phantom{0(13\frac{4}{12}} \\
40\phantom{(13\frac{4}{12}} \\
\underline{36}\phantom{(13\frac{4}{12}} \\
4\phantom{(13\frac{4}{12}}
\end{array}
$$

We find, by division, it will take 13 hours, and still 4 pages remain to be read. Now, since it takes $\frac{1}{12}$ of an hour to read 1 page, it will take $\frac{4}{12}$ of an hour to read 4 pages. *Ans.* 13$\frac{4}{12}$ hours.

Any REMAINDER, *which appears after the operation of division, is the numerator of a fraction, the divisor being the denominator; and this fraction forms a part of the quotient.* Therefore, *place the remainder and the divisor, as a fraction, to the right of the quotient.*

2. At $2 per yard, how many yards of cloth can be bought for $49; that is, how many whole yards, and what part of another yard can be bought?

3. How many times 2 are there in 49?

4. How much flour can be bought for $639, at $5 per barrel; that is, how many barrels, and what part of another barrel can be bought?

5. In 639, how many times 5;—that is, how many fives, and what part of another 5, in 639?

6. How much salt can be bought for 87 shillings, at 4 shillings per bushel?

7. Suppose a rail-way car to run 16 miles an hour; in how many hours will it run 350 miles?

8. How many times 12 are there in 1049?

9. How many times 39 are there in 76800?

10. In 438 shillings, how many pounds are there?

Observe that 1s. is $\frac{1}{20}$ of £1; therefore the remainder in this example, may be expressed as a fraction.

11. How many yards of cloth can be bought for 549 shillings, at £1 per yard?

12. Suppose a ton of hay to be equal in value to 34 bushels of oats; how many tons of hay must be given for 450 bushels of oats?

13. How many times 17 are there in 23 times 31?

14. How much rice, at $4 per cwt., must be given for 620 lb. of cheese, at 10 cents per pound?

SECTION 14.

CHANGE OF WHOLE NUMBERS TO FRACTIONS.

1. How many thirds are there in 14?

$$\begin{array}{r} 14 \\ 3 \\ \hline 42 \end{array}$$

42-thirds. *Ans.* $\frac{42}{3}$.

In 1 there are 3 thirds, therefore, there are 3 times as many thirds as whole ones, in any whole number.

RULE. *To change a whole number to an improper fraction, multiply the whole number by the denominator, and the product will be the numerator.*

2. If you cut 17 sheets of paper into half-sheets, how many halves will there be?

3. How many fifths of a dollar are there $16?

4. In 31 pounds, how many sixths of a pound?

5. In 73 yards, how many eighths of a yard?

6. Change 641 to ninths. Change 641 to tenths.

7. If a stage run 1 mile in $\frac{1}{9}$ of an hour, how many miles would it run in 126 hours?

8. How many fourths are there in $15\frac{3}{4}$?

$$\begin{array}{c} 15\frac{3}{4} \\ 4 \\ \hline 63\text{-fourths.} \end{array}$$

In this example, we add the 3-fourths to the fourths produced by the multiplication of 15 by 4, and thus obtain $\frac{63}{4}$.

Note. A whole number and a fraction expressed together, thus, $15\frac{3}{4}$, is called a ***mixed number.***

9. How many eighths of a mile in $57\frac{1}{8}$ miles?

10. Change $86\frac{10}{17}$ to an improper fraction.

11. Change $4\frac{1}{63}$ to an improper fraction.

12. If $\frac{1}{5}$ of a dollar will pay for 1 gallon of beer, how much beer can be bought for $\$6\frac{4}{5}$?

13. If $\frac{1}{8}$ of a dollar will pay for 3 yards of ribbon, how many yards can be bought for $\$6\frac{5}{8}$?

SECTION 15.

CHANGE OF FRACTIONS TO WHOLE NUMBERS.

1. How many whole ones are there in $\frac{42}{3}$?

$$\begin{array}{l} 3)\underline{42}\text{-thirds.} \\ \quad 14 \text{ wholes.} \end{array}$$

Since $\frac{3}{3}$ make a whole 1, there are as many whole ones in $\frac{42}{3}$ as there are times 3 in 42.

RULE. *To change an improper fraction to a whole number, divide the numerator by the denominator, and the quotient will be the whole number.*

2. How many whole sheets of paper must be cut into halves, to make $\frac{48}{2}$ of a sheet?

3 In $\frac{245}{5}$ of a dollar, how many dollars?

4 How many pounds are there in $\frac{132}{6}$ of a pound?

5. In $\frac{1216}{8}$ of a yard, how many yards are there?

6. If a stage run 1 mile in $\frac{1}{9}$ of an hour, how many hours would it be in running 126 miles?

7. Change $\frac{312}{24}$ to a whole number.

8. Suppose 8 pounds of sugar can be bought for $1; how many pounds will $\frac{2650}{10}$ of a dollar pay for?

9. Change $\frac{87}{5}$ to a mixed number?

$$\begin{array}{r} 5\overline{)87} \\ \hline 17\frac{2}{5} \end{array}$$

We divide the 87-fifths by 5, and obtain 17 whole ones: then, there are 2-fifths over, making $17\frac{2}{5}$.

10. Change $\frac{242}{7}$ to a mixed number.

11. How many dollars are there in $\frac{507}{8}$ of a dollar?

12. How many gallons in $\frac{752}{16}$ of a gallon?

13. If $\frac{1}{5}$ of a dollar will pay for 1 pound of coffee, how many dollars will 312 pounds of coffee cost?

14. If 1 pound of butter cost $\frac{1}{6}$ of a dollar, what would be the price of 491 pounds, at the same rate?

Section 16.

1. Add together $\frac{5}{14}$, $\frac{12}{14}$, $\frac{9}{14}$, $\frac{13}{14}$, $\frac{11}{14}$ and $\frac{6}{14}$.

The sum of these fractions will be an improper fraction, and it must be changed to a mixed number.

2. What is the sum of $491\frac{9}{11}$, $75\frac{8}{11}$ and $836\frac{6}{11}$?

$$\begin{array}{r} 491\frac{9}{11} \\ 75\frac{8}{11} \\ 836\frac{6}{11} \\ \hline 1404\frac{1}{11} \end{array}$$

In this example, we add together the elevenths, and find their sum to be $\frac{23}{11}$; which is equal to $2\frac{1}{11}$. The $\frac{1}{11}$ we write down, and carry the 2 to the column of units.

3. What is the sum of $419\frac{2}{7}$, $18\frac{5}{7}$, $12\frac{6}{7}$, $8573\frac{4}{7}$, $9\frac{1}{7}$, $251\frac{6}{7}$, $141\frac{6}{7}$, and $25\frac{4}{7}$?

4. Add together $336\frac{9}{25}$, $14\frac{12}{25}$, $9701\frac{18}{25}$, 28, $158\frac{10}{25}$, $1240\frac{7}{25}$, $\frac{21}{25}$, $100\frac{4}{25}$, and $\frac{19}{25}$.

5. Subtract $1876\frac{5}{9}$ from $2258\frac{3}{9}$.

$$\begin{array}{r} 2258\frac{3}{9} \\ 1876\frac{5}{9} \\ \hline 381\frac{7}{9} \end{array}$$

We cannot take $\frac{5}{9}$ from $\frac{3}{9}$, therefore, we join 1 unit with the $\frac{3}{9}$, making $\frac{12}{9}$, and take $\frac{5}{9}$ from $\frac{12}{9}$. We then proceed to take 6 units from 7 units.

6. Subtract $46031\frac{4}{5}$ from $71706\frac{1}{5}$.

7. Subtract $609\frac{41}{68}$ from $5420067\frac{19}{68}$.

8. If $17\frac{5}{8}$ yards of cloth be cut from a piece containing 49 yards, how much will be left?

9. A retailer put into a firkin, $28\frac{3}{16}$ pounds of butter at one time, $19\frac{4}{16}$ pounds at another, and $35\frac{7}{16}$ pounds at another, and then sold out $25\frac{15}{16}$ pounds. How many pounds still remained in the firkin?

SECTION 17.

1. Suppose a rail-road car to run $\frac{3}{5}$ of a mile in 1 minute; what distance will it run in 47 minutes?

2. How many whole ones in 47 times $\frac{3}{5}$?

3. If $\frac{7}{8}$ of a yard of broad-cloth will make 1 jacket, how many yards will it take to make 18 jackets?

4. How many whole ones in 18 times $\frac{7}{8}$?

5. If $\frac{4}{9}$ of a pound of gunpowder tea cost 1 dollar, how many pounds can be bought for 50 dollars?

6. How many whole ones in 50 times $\frac{4}{9}$?

SECTION 18.

1. What is the product of $86\frac{4}{7}$, multiplied by 9?

$$\begin{array}{r} 86\frac{4}{7} \\ 9 \\ \hline 779\frac{1}{7} \end{array}$$

We multiply $\frac{4}{7}$ by 9 thus, 9 times $\frac{4}{7}$ is $\frac{36}{7}$; equal to $5\frac{1}{7}$. Then we write this $\frac{1}{7}$ under the $\frac{4}{7}$, and carry the 5 to the product of the 6 units.

2. What is the product of $41\frac{8}{9}$, multiplied by 7?

3 What is the value of a field, which contains 5 acres, allowing it to be worth $54\frac{7}{8}$ dollars per acre?

4. How much is 4 times $35\frac{13}{20}$?

5. How much is 9 times $14731\frac{24}{48}$?

6. How much is 28 times $54\frac{2}{3}$?

$$\begin{array}{r} 54\frac{2}{3} \\ 28 \\ \hline 432 \\ 108 \\ 18\frac{2}{3} \\ \hline 1530\frac{2}{3} \end{array}$$

Here we are obliged to multiply by 8 units and 2 tens separately, and we cannot well bring in the product of the fraction by the 2 tens. Therefore, we first multiply the whole numbers, and then find 28 times $\frac{2}{3}$, in a separate operation, which is not here written.

7. How much is 92 times $2051\frac{6}{10}$?

8. How much is 100 times $14\frac{9}{15}$?

9. How many gallons of wine are there in 31 casks, each cask containing $54\frac{5}{16}$ gallons?

10. A merchant paid $\$75\frac{42}{100}$ apiece, for 47 mules. What did the whole amount to?

11. If a steam-boat run $236\frac{15}{18}$ miles in 1 day, what distance will it run in 16 days?

12. How much is 15 times $\frac{27}{49}$?

13. What cost 75 books, at $\frac{37}{100}$ of a dollar apiece?

14. If a horse eat $\frac{13}{16}$ of a bushel of oats a day, how many bushels will he eat in 365 days?

Section 19.

1. If $\frac{1}{5}$ of a chest of tea be worth $\$6.87\frac{1}{2}$, what is the whole chest worth?

2. If $\frac{1}{10}$ of a dollar will pay for travelling $27\frac{3}{4}$ miles on a turnpike road, how far can you go for $1?

3. $790\frac{5}{8}$ is $\frac{1}{19}$ of what number?

4. If $\frac{1}{7}$ of a kite line be $25\frac{5}{6}$ yards in length, what is the whole length of the line?

5. $305\frac{6}{13}$ is $\frac{1}{9}$ of what number?

6. If a man can earn $12\frac{1}{2}$ cents in $\frac{1}{8}$ of a day, what sum of money can he earn in 1 day?

7. If $\frac{1}{8}$ of a yard of gold wire be worth $\frac{15}{16}$ of a dollar, what is the value of 1 yard of the wire?

Section 20.

1. A boy having $2, gave $\frac{1}{5}$ of his money for a knife What fraction of 1 dollar did the knife cost?

2. $\frac{1}{5}$ of 2 is equal to what part of 1?

3. 6 men divided 5 barrels of flour equally among them, each man taking $\frac{1}{6}$ of the flour in each barrel. What fraction of a barrel did each man get?

4. $\frac{1}{6}$ of 5 is equal to what part of 1?

5. If you should take $\frac{1}{16}$ of a bushel of corn from each of 10 bushels, what fraction of 1 bushel would you obtain?

6. What part of 1 is $\frac{1}{16}$ of 10?

7. What part of 1 is $\frac{1}{39}$ of 2? is $\frac{1}{39}$ of 3? is $\frac{1}{39}$ of 4? is $\frac{1}{39}$ of 18? is $\frac{1}{39}$ of 38?

8 A tenant raised 28 bushels of corn, and gave his landlord $\frac{1}{3}$ of it. What improper fraction of a bushel, [how many thirds of a bushel,] did the landlord receive? How many bushels did the landlord receive?

9. $\frac{1}{3}$ of 28 is equal to what improper fraction? Then $\frac{1}{3}$ of 28 is equal to how many whole ones?

10. $\frac{1}{5}$ of 42 is equal to what improper fraction? Then $\frac{1}{5}$ of 42 is equal to what mixed number?

11. $\frac{1}{13}$ of 29 is equal to what improper fraction? Then $\frac{1}{13}$ of 29 is equal to what mixed number?

12. If \$721 should be divided equally among 6 men, how many sixths of a dollar would each man have? How many dollars would each man have?

SECTION 21.

1. Suppose a hogshead of brown sugar to be worth \$115; what is the value of $\frac{1}{4}$ of the sugar?

2. What is $\frac{1}{4}$ of 115?

3. 5 men from Connecticut, bought 793 acres of land in Michigan, and divided it into 5 equal farms. How many acres were there in each farm?

To find $\frac{1}{5}$ of 793 acres, we divide 793 by 5. The quotient is 158 acres, and there is a remainder of 3 acres. To divide these 3 acres, we take $\frac{1}{5}$ of each acre for each farm. $\frac{1}{5}$ of 3 acres is $\frac{3}{5}$ of 1 acre.

4. What is $\frac{1}{6}$ of 1315? $\frac{1}{8}$ of 530? $\frac{1}{9}$ of 8201?

5. Suppose 12 men to share equally in a prize of \$551.20; what is each man's share?

6. What is $\frac{1}{12}$ of 55120? $\frac{1}{28}$ of 967? $\frac{1}{43}$ of 700?

7. The *Young Ladies' Class Book*, which consists of 408 pages of select reading lessons, has been read through by 25 scholars; each reading an equal portion. How many pages did 1 scholar read?

8. $\frac{1}{6}$ of £1 [$\frac{1}{6}$ of 20s.] is how many shillings, and what fraction of a shilling?

9. Find $\frac{1}{9}$ of £7 in shillings—that is, reduce £7 to shillings, and find $\frac{1}{9}$ of the number of shillings.

10. $\frac{1}{8}$ of 5 shillings is how many pence?

11. How many grains in $\frac{1}{10}$ of 6 pennyweights?

12. $\frac{1}{6}$ of 3 ounces is how many drams?

13. 11 men divided 9 hogsheads of molasses equally among them. How many gallons had each man?

14. $\frac{1}{16}$ of 7 furlongs is how many rods?

15. $\frac{1}{7}$ of 6 square feet is how many square inches?

16. How many seconds are there in $\frac{1}{12}$ of 10 hours?

17. A trader sold $\frac{1}{4}$ of a hogshead of wine at 37 cents for every $\frac{1}{4}$ of a gallon. What did it amount to?

SECTION 22.

1. If 34 barrels of flour be made from 147 bushels of wheat, how much wheat will make 9 barrels of flour?

2. What is 9 times $\frac{1}{34}$ of 147?

3. If 8 yards of broad-cloth cost $38, what will 13 yards cost, at the same rate?

4. What is 13 times $\frac{1}{8}$ of 38? 7 times $\frac{1}{10}$ of 654? 5 times $\frac{1}{14}$ of 270? 21 times $\frac{1}{15}$ of 40975?

5. If it cost $1.25 to ride 20 miles in a stage, how much will it cost to ride 32 miles?

6. If $16 will pay for 85 pounds of butter, how many pounds will $25 pay for?

7. If 12 cords of wood cost $75, what will be the cost of 19 cords, at the same rate?

8. Suppose 21cwt. of flour to be worth the same as 65 bushels of salt; how many bushels of salt must be given in exchange for 18cwt. of flour?

9. If 8 barrels will hold 19bu. 3pk. 4qt. of corn, how much corn can be put into 15 barrels?

SECTION 23.

1. When writing paper is sold at $5.42 per ream, what is the price of $\frac{1}{4}$ of a ream?

2. If $\frac{1}{4}$ of a ream of paper is worth 1.35\frac{2}{4}$, what is $\frac{3}{4}$ of a ream worth?

3. Suppose a hogshead of sugar to be worth $93; what is $\frac{1}{7}$ of it worth?

4. If $\frac{1}{7}$ of a hogshead of sugar is worth 13.28\frac{4}{7}$, what is $\frac{2}{7}$ of it worth?

5. What is $\frac{1}{8}$ of 3765? What is $\frac{5}{8}$ of 3765?

6. How many gallons are there in $\frac{1}{9}$ of a pipe of wine? How many gallons in $\frac{7}{9}$ of a pipe?

In the following examples, it will be most convenient to multiply by the numerator of the fraction, before dividing by the denominator. See *Second Method* of operation, exemplified in page 152.

7. The highest point of the Andes, is 21440 feet Mont Blanc, of the Alps, is $\frac{7}{9}$ as high. What is the height of Mont Blanc?

8. Virginia contains 66000 square miles: Rhode Island is only $\frac{2}{99}$ as large. How many square miles are there in Rhode Island?

9. If a man's income be $1000 per year, what is his income for 9 months, or $\frac{9}{12}$ of a year?

10. Suppose a man by constant industry can earn $1.50 per day; what will he earn in 10 days, allowing him to rest $\frac{2}{7}$ of the time?

11. How much must be paid for $\frac{13}{20}$ of a ton of Russia hemp, when the price is $210 per ton?

12. A man having 4 miles to go, rode $\frac{7}{9}$ of the way, and walked the remainder. How many rods did he walk?

13. Suppose 45000 pounds of iron to be sufficient to lay the track on 1 mile of rail-way; how many pounds of iron are required to lay the track on $1\frac{7}{8}$ mile?

14. How much is 4500 plus $\frac{7}{8}$ of 4500?

15. Suppose a rail-way car to run 350 miles a day; what distance will it run in $5\frac{3}{4}$ days?

16. How much is $5\frac{3}{4}$ times 350?—That is,—how much is 5 times 350 and $\frac{3}{4}$ of another time 350?

17. How much is $6\frac{2}{5}$ times 91? $8\frac{4}{9}$ times 146? $3\frac{5}{6}$ times 244? $12\frac{4}{7}$ times 379? $16\frac{7}{10}$ times 978?

PERCENTAGE.

The term, *per cent.*, is an abbreviation of *per centum*, and signifies, *by the hundred*. 1 per cent. of any number, is $\frac{1}{100}$ of that number; 2 per cent. is $\frac{2}{100}$; 3 per cent. is $\frac{3}{100}$; 4 per cent. is $\frac{4}{100}$; and so on.

18. What is 5 per cent. of 360 dollars?

$$\begin{array}{r} 360 \\ 5 \\ \hline \$18.00 \end{array}$$

Since 5 per cent. is $\frac{5}{100}$, we multiply by 5, and divide by 100. To divide by 100, we merely point off two figures from the right, as taught in page 116.

19. What is 1 per cent. of 100? 2 per cent. of 100?

20. What is 2 per cent. or $\frac{2}{100}$ of 350 dollars?

21. A merchant, who has \$3875 deposited in the bank, wishes to draw out 4 per cent. of his deposit How many dollars must he draw?

22. What is 6 per cent. or $\frac{6}{100}$ of 4250 dollars?

23. What is 6 per cent. of \$92.50, or 9250 cents?

24. What is 4 per cent. of \$132.75?

25. A merchant having 2513 gallons of wine on hand lost 1 per cent. of the whole, by leekage from the casks. How many gallons did he lose?

26. Find 6 per cent. of 128 dollars.

$$\begin{array}{r} 128 \\ 6 \\ \hline \$7.68 \end{array}$$

After multiplying and dividing, our quotient is $\$7\frac{68}{100}$. Now, since $\frac{1}{100}$ of a dollar is 1 cent, $\frac{68}{100}$ of a dollar is 68 cents: therefore the answer is \$7.68.

27. Find 7 per cent. of 2517 dollars.

28. Find 18 per cent. of 20 dollars.

29. What is 4 per cent. of \$70.14, or 7014 cents?

In this example, after multiplying by 4, and dividing by 100, there is a remainder of 56. And since the quotient is *cents*, this remainder is $\frac{56}{100}$ of a cent.

30. What is 9 per cent. of \$470.46?

31. What is 55 per cent. of \$964.07?

32. A and B have \$500 apiece. If A should give B 6 per cent. of his cash, what would each then have?

33. What is $\frac{1}{2}$ of 1 per cent. of 62 dollars?

34. What is $4\frac{1}{2}$ per cent. of 62 dollars?

35. What is $\frac{1}{3}$ per cent. of 246 dollars?

36. What is $5\frac{1}{3}$ per cent. of 246 dollars?

37. A merchant paid \$491 for a quantity of salt: for how much must he sell it, to gain 9 per cent.?

38. A trader paid \$230 for a piece of cloth, containing 46 yards, and sold it so as to lose 4 per cent At how much did he sell it per yard?

39. If I pay \$525 for 90 barrels of flour, at what price per barrel must I sell it, to gain 7 per cent.?

40. Suppose a merchant to pay \$85 per ton for 6 tons of iron; at what price must he sell it per hundred weight, in order to gain 12 per cent.?

41. A merchant failed in business, and was able to pay his creditors only 65 per cent. of their demands. What did he pay on a demand of $534?

INTEREST.

Interest is money paid for the use of money that has been owed. For instance, suppose that A lends B $100 for one year, and at the end of the year, B pays, not only the $100, but also pays $6 for the use of the $100· in this case, $6 is the interest.

The money for which interest is paid, is called the *Principal.* The sum per cent. paid for one year's interest, is called the *Rate.* The principal and interest added together, are called the *Amount.*

RULE FOR COMPUTING INTEREST *Multiply the principal by the rate per cent., and divide the product by* 100: *the quotient will be the interest for* 1 *year.*

42. What is the interest of $100, for 1 year, at 5 per cent.? What is the amount?

43. What is the interest of $1 or 100 cents, for 1 year, at 5 per cent.? What is the amount?

44. What is the interest of $354, at 6 per cent. for 1 year? for 2 years? for 3 years? for 4 years? What is the amount for 4 years?

45. What is the interest of $40.50, for 4 years, at 6 per cent.? What is the amount?

46. What is the interest of $18, for 3 years, at 7 per cent.? What is the amount?

47. What will $8410 amount to in 15 years; the rate of interest being 4 per cent.?

48. What is the interest of $6470, for 3 years, at 5½ per cent.? What is the amount?

When interest is to be computed for any number of months,—First find the interest for 1 *year; then take* $\frac{1}{12}$ *of a year's interest for* 1 *month;* $\frac{2}{12}$ *or* $\frac{1}{6}$ *for* 2 *months,* $\frac{3}{12}$ *or* $\frac{1}{4}$, *for* 3 *months; and so on.*

49. What is the interest of $35, for one month, at 6 per cent. per annum? What is the amount?

50. What is the interest of $21, for 2 months, at 7 per cent. per annum?

51. What is the interest of $4291, for 3 months, at 5 per cent. per annum?

52. At 4 per cent. per annum, what is the interest of $122.75 for 4 months? for 5 months? for 6 months? for 7 months? for 8 months? for 9 months? for 10 months? What is the amount for 11 months?

53. What is the interest of $14.50, for 1 year and 1 month, at 6 per cent.?

54. What is the interest of $19.25, for 3 years and 2 months, at 8 per cent.?

55. What is the amount of $458, for 2 years and 3 months, at 7 per cent.?

56. What is the amount of $8.75 for 5 years and 4 months, at 4 per cent.?

57. What is the amount of $91.50, for 2 years and 7 months, at 8 per cent.?

58. What is the interest of $81, from February 7, 1832, to August 7, 1835, at 6 per cent.?

59. Suppose a promissory note of $145, to be dated, January 15, 1831; what will be the amount of that note, October 15, 1834; the rate being 6 per cent.?

60. A owed B $96, on interest at 6 per cent. At the end of 2 years, A paid the interest then due, and $25 of the principal: at the end of 3 years and 11 months, he paid the whole debt. What was each payment?

When interest is to be computed for any number of days,—First find the interest for 1 month; then take $\frac{1}{30}$ *of a month's interest for 1 day;* $\frac{2}{30}$ *or* $\frac{1}{15}$ *for 2 days,* $\frac{3}{30}$ *or* $\frac{1}{10}$ *for 3 days;* $\frac{4}{30}$ *or* $\frac{2}{15}$ *for 4 days;* $\frac{5}{30}$ *or* $\frac{1}{6}$ *for 5 days;* $\frac{6}{30}$ *or* $\frac{1}{5}$ *for 6 days; and so on.*

In the following operations, in this section, all fractions of a cent may be disregarded: this being the common practice in business.

61. What is the interest of $231, for 7 days, at 6 per cent. per annum?

Direction. First find the interest for 1 year; then for $\frac{1}{12}$ of a year or 1 month; and then for $\frac{7}{30}$ of a month.

62. What is the interest of $75, for 10 days, at 6 per cent. per annum?

63. What is the interest of $254 for 21 days, at 6 per cent. per annum?

64. What is the interest of $110, for 5 months, and 8 days, at 6 per cent. per annum?

65. What is the interest of $34 for 1 year, 3 months, and 25 days, at 6 per cent. per annum?

66. What is the interest of $91.18, for 3 years, 2 months, and 13 days, at 6 per cent. per annum?

Several other methods are practised by merchants, in computing interest; among which, are the following.

When the rate is 5 *per cent.—Divide the principal by* 20, *and the quotient is the interest for* 1 *year.*

67. What is the interest of $4207, for 2 years, at 5 per cent. per annum?

68. What is the interest of $951.17, for 4 years, at 5 per cent. per annum?

When the rate is 6 *per cent.—Multiply the principal by half the number of months in the time, divide the product by* 100, *and the quotient is the interest.*

69. What is the interest of $119, for 16 months, at 6 per cent. per annum?

70. What is the interest of $96.48, for 10 months, at 6 per cent. per annum?

71. What is the amount of $27.56, on interest 6 months, at 6 per cent. per annum?

72. What is the interest of $133.24, for 11 months, at 6 per cent. per annum?

To find the interest for DAYS, *the rate being* 6 *per cent.—Multiply the principal in dollars by the number of days, divide the product by* 6, *and cut off one figure from the right of the quotient. The rest of the quotient figures express* NEARLY *the interest, in cents.*

73. What is the interest of $249, for 75 days, at 6 per cent. per annum?

74. What is the interest of $5824, for 21 days, at 6 per cent. per annum?

75. What difference will it make to the man who pays interest on $100 for 1 year, whether it be computed by *days*, or according to *true rule* in page 165?

DISCOUNT.

Discount is an abatement of a certain part of a debt when the debt is paid before it becomes due. For instance; suppose that A is bound to pay B $106, in one year from the present time; but B, wanting the money now, agrees to receive $100 for the debt, on condition of present payment: in this case, $100 is the *present worth* of the debt, and $6 is the *discount*.

The present worth of any debt due at a future period, is that sum of money, which, if put at interest, would amount to the debt by the time it becomes due. Therefore, when the interest is 5 per cent., that is, $\frac{5}{100}$ of the principal, then the discount is $\frac{5}{105}$ of the principal.

RULE FOR COMPUTING DISCOUNT. *Multiply the principal by the number of cents found to be the interest of one dollar for the time, and divide the product by the number which results from adding* 100 *to the multiplier The quotient will be the discount.*

For example, at the rate of 6 per cent., the discount on $124.25, due in 1 year and 10 months, is found thus —

$$\begin{array}{r} 124.25 \\ 11 \\ \hline 111)\overline{1366.75}(13.21\frac{34}{111} \end{array}$$

76. What is the discount on $48.51, due in 3 years; the rate of interest being 5 per cent.?

77. What is the discount on $247, due in 1 year, the rate of interest being 6 per cent.?

78. What is the present worth of $150, due in 1 year, the rate of interest being 6 per cent.?

Find the discount, and subtract it from the debt.

79. What is the present worth of $1640, due in 2 years, the rate of interest being 5 per cent.?

80. Find the difference between the discount and the interest of $100 for 1 year, the rate being 6 per cent.

81. Find the present worth of $75, due in 2 years and 9 months, [$2\frac{3}{4}$ years], interest being 6 per cent.

SECTION 24.

1. Suppose $\frac{3}{4}$ of a piece of broad-cloth to be worth $118.87; what is $\frac{1}{4}$ of the piece worth? What is the whole piece worth?

2. 11887 is $\frac{3}{4}$ of what number?

3. If the interest of $100 be $3.50 for $\frac{7}{12}$ of a year, what is the interest of $100 for $\frac{1}{12}$ of a year? Then what would be the interest for 1 year?

4. If $\frac{15}{24}$ of an acre of land produce 133 bushels of potatoes, how many bushels does $\frac{1}{24}$ of an acre produce? How many bushels would 1 acre produce?

5. 9071 is $\frac{8}{20}$ of what number?

6. If a man earn $190 a year by working $\frac{7}{10}$ of the time, how much could he earn by working constantly?

7. $14 is 8 per cent. or $\frac{8}{100}$ of what sum of money?

SECTION 25.

CHANGE OF THE TERMS OF FRACTIONS.

The numerator and denominator of a fraction, are called the two *terms* of a fraction. These terms may be changed, and the fraction may still express the same quantity. For instance, the terms 2 and 3, in the fraction $\frac{2}{3}$, may be changed to 4 and 6, and the fraction will become $\frac{4}{6}$, which is still equal to $\frac{2}{3}$.

1. $\frac{5}{8}$ is equal to how many twenty-fourths?

Direction. 8-eighths are equal to 24-twenty-fourths; therefore, find $\frac{5}{8}$ of 24, and this number will be the required numerator of $\frac{}{24}$.

2. $\frac{3}{7}$ is equal to how many fourteenths?

3. Change $\frac{2}{3}$ to eighteenths and add $\frac{6}{18}$ to it.

4. $\frac{7}{9}$ is equal to how many forty-fifths?

5 Change $\frac{6}{10}$ to fortieths, and then take $\frac{11}{40}$ from it.

SECTION 26.

REDUCTION OF FRACTIONS TO LOWER TERMS

When a number can be found, that will divide both terms of a fraction, without a remainder, the two quotients arising from the division, will express the fraction *reduced to lower terms.* For example, both terms of the fraction $\frac{6}{12}$ can be divided by 3, and the reduced fraction will be $\frac{2}{4}$. Again, both terms of $\frac{2}{4}$ can be divided by 2, and the reduced fraction will be $\frac{1}{2}$. Thus any fraction may be reduced to its *lowest terms*, by repeatedly dividing the terms, until no number will divide them both without a remainder.

1. Reduce each of the following fractions to its lowest terms. $\frac{3}{6}$. $\frac{6}{9}$. $\frac{4}{12}$. $\frac{9}{12}$. $\frac{10}{15}$. $\frac{6}{18}$. $\frac{18}{27}$. $\frac{12}{24}$.

2. Reduce each of the following fractions to its lowest terms. $\frac{10}{50}$. $\frac{20}{80}$. $\frac{100}{300}$. $\frac{600}{800}$. $\frac{10}{100}$. $\frac{45}{90}$. $\frac{30}{1200}$.

Only once dividing the terms of a fraction, will reduce it to its lowest terms, if we use the *greatest common divisor*, that is, the greatest number that will divide both terms without a remainder.

TO FIND THE GREATEST COMMON DIVISOR of two numbers,—Divide the greater number by the smaller, then divide the divisor by the remainder; and thus continue dividing the last divisor by the last remainder, till nothing remains. The divisor used last of all, will be the greatest common divisor.

3. Find the greatest common divisor of 91 and 117.

```
91)117(1
   91
   --
   26)91(3
      78
      --
      13)26(2
         26
         --
```

This operation is performed according to the direction above, and 13 is found to be the greatest common divisor; or the greatest number by which 91 and 117 can be divided without a remainder.

4. Find the greatest common divisor of 15 and 235.

5. Reduce $\frac{72}{189}$ to its lowest terms, by using the greatest common divisor of the two terms.

6. Reduce to their lowest terms, $\frac{192}{576}$, $\frac{156}{336}$, and $\frac{323}{425}$

SECTION 27.

COMPOUND FRACTIONS.

A compound fraction arises from dividing a unit into a certain number of equal parts, and then dividing one of these parts into other equal parts

TO REDUCE A COMPOUND FRACTION TO A SIMPLE FRACTION,—Multiply all the numerators together for a new numerator, and all the denominators for a new denominator: then reduce the new fraction to its lowest terms.

1. Reduce $\frac{2}{5}$ of $\frac{1}{2}$ to a simple fraction.

2. $\frac{1}{4}$ of a water melon was divided equally among 6 boys. What fraction of the melon did 1 boy receive?

3. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ to a simple fraction.

4. $\frac{7}{8}$ of an acre of land was divided into 4 equal lots. What fraction of an acre did 2 lots contain?

5. Reduce $\frac{7}{9}$ of $\frac{4}{5}$ to a simple fraction.

6. $\frac{5}{6}$ of $\frac{6}{14}$ is equal to what part of 1?

7. Reduce $\frac{3}{17}$ of $\frac{9}{11}$ to a simple fraction.

8. 1 penny is what part of 1s.? what part of £1?

9. 7 pence is what simple fraction of £1?

Suggestion. 7 pence is $\frac{7}{12}$ of 1 shilling, and 1 shilling is $\frac{1}{20}$ of £1. Therefore, 7 pence is $\frac{7}{12}$ of $\frac{1}{20}$ of £1.

10. Reduce 10 grains to the fraction of an ounce; that is, reduce $\frac{10}{24}$ of $\frac{1}{20}$ to a simple fraction.

11. Reduce 3 nails to the fraction of a yard.

12. Reduce 4 inches to the fraction of a yard. 1/9

13. Reduce 25 seconds to the fraction of an hour.

14. Reduce $\frac{2}{3}$ of $\frac{1}{4}$ of $\frac{3}{5}$ to a simple fraction.

15. $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{2}{10}$ is equal to what part of 1?

16. Reduce $\frac{6}{13}$ of $\frac{12}{30}$ of $\frac{5}{78}$ to a simple fraction.

When the lower denominations of a compound number are to be reduced to the fraction of a higher denomination,—First, reduce the given quantity to the lowest denomination mentioned, and this number will be the numerator: then reduce a unit of the higher denomination, to the same denomination with the numerator, and this number will be the denominator.

17. Reduce 14s. 10d. 2qr. to the fraction of £1.

14s. 10d. 2qr.	£1 is 20s.
12	12
178d.	240d.
4	4
Num. 714 qr.	*Denom.* 960 qr.

The denominator and numerator here found, make $\frac{714}{960}$: this fraction, when reduced, is $\frac{119}{160}$.

18. Reduce 2s. 7d. 1qr. to the fraction of £1.
19. Reduce 11d. 3qr. to the fraction of a pound.
20. Reduce 15s. 0d. 3qr. to the fraction of a pound.
21. Reduce 10d. 1qr. to the fraction of a shilling.
22. Reduce 2s. 9d. 3$\frac{4}{5}$qr. to the fraction of a pound.

Direction. Find the number of *fifths* of a farthing in 2s. 9d. 3$\frac{4}{5}$qr., for a numerator; then find the number of fifths of a farthing in £1, for a denominator.

23. Reduce 8$\frac{4}{7}$ pence to the fraction of a pound.
24. Reduce 5qt. 1pt. to the fraction of a bushel.
25. Reduce 9gal. 3qt. 1pt. to the fraction of 1hhd.
26. Reduce 6 rods 3yd. 2ft. to the fraction of a mile
27. Reduce 35$\frac{1}{10}$ seconds to the fraction of a day.

When the fraction of a higher denomination is to be reduced to its value in whole numbers of lower denomination,— Multiply the numerator by that number of the next lower denomination which is required to make a unit of the higher, and divide the product by the denominator; the quotient will be a whole number of the lower denomination, and the remainder will be the numerator of a fraction. Proceed with this fraction as before, and so on.

28. Reduce $\frac{2}{7}$ of £1 to its value in shillings, &c.

$$\begin{array}{rrr}
 & 2 & \\
 & \underline{20} & \\
7) & \underline{40} & \\
 & 5 & 5\\
 & & \underline{12}\\
 & 7) & \underline{60}\\
 & 8 & 4\\
 & & \underline{4}\\
 & 7) & \underline{16}\\
 & & 2\frac{2}{7}
\end{array}$$

Since $\frac{2}{7}$ of £1 is the same as $\frac{2}{7}$ of 20 shillings, we find $\frac{2}{7}$ of 20 shillings, in shillings and the fraction of a shilling;— it is 5$\frac{5}{7}$ shillings. Then, since $\frac{5}{7}$ of 1 shilling is the same as $\frac{5}{7}$ of 12 pence, we find $\frac{5}{7}$ of 12 pence;— it is 8$\frac{4}{7}$ pence. Then, since $\frac{4}{7}$ of 1 penny is the same as $\frac{4}{7}$ of 4 farthings, we find $\frac{4}{7}$ of 4 farthings;— it is 2$\frac{2}{7}$ farthings. Thus by finding one denomination at a time, we finally obtain, 5s. 8d. 2$\frac{2}{7}$qr.

29. Reduce $\frac{2}{3}$ of £1 to its value in shillings &c.
30. $\frac{4}{9}$ of £1 is how many shillings, pence, &c.?
31. In $\frac{3}{8}$ of a shilling, how many pence, &c.?
32. Change £15 $\frac{4}{7}$ to pounds, shillings, pence, &c.
33. Reduce $\frac{7}{9}$ of 1 cwt. to quarters, pounds, &c.

34. Change $9\frac{6}{10}$ pounds, to pounds, ounces, and drams
35. Reduce $\frac{5}{9}$ of a mile to furlongs, rods, feet, &c.
36. In $10\frac{2}{7}$ acres, how many acres, roods, rods, &c.
37. How many dimes, cents, and mills, in $\frac{7}{12}$ of $1?
38. In $\frac{5}{11}$ of a dollar, how many cents and mills?
39. Suppose sugar to be $12 per hundredweight; what quantity can be purchased for $113?

Section 28.

COMMON DENOMINATORS.

When two or more fractions have the same number for a denominator, this number is called their *Common Denominator*. Fractions having different denominators, must be reduced to a common denominator, before addition or subtraction can be performed on them.

RULE FOR REDUCING FRACTIONS TO A COMMON DENOMINATOR. ***Multiply each numerator into all the denominators except its own, for a new numerator. Then multiply all the denominators together for a common denominator, and place it under each new numerator.***

1. Reduce $\frac{5}{8}$, $\frac{4}{9}$, and $\frac{6}{7}$, to a common denominator.

$$\begin{array}{rrrr}
5 & 4 & 6 & 8 \\
\underline{9} & \underline{8} & \underline{8} & \underline{9} \\
45 & 32 & 48 & 72 \\
\underline{7} & \underline{7} & \underline{9} & \underline{7} \\
\frac{315}{504} & \frac{224}{504} & \frac{432}{504} & 504
\end{array}$$

2. Reduce $\frac{2}{5}$, $\frac{4}{10}$, and $\frac{1}{3}$ to a common denominator.
3. Reduce $\frac{11}{14}$ and $\frac{6}{15}$ to a common denominator.
4. Reduce $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{19}{30}$ to a common denominator.
5. Reduce $\frac{4}{7}$, $\frac{1}{3}$, $\frac{2}{5}$, and $\frac{1}{4}$ to a common denominator.
6. How much is $\frac{2}{9}$ and $\frac{4}{7}$ added together?
7. How much is $\frac{12}{17}$ and $\frac{16}{25}$ added together?
8. How much is $\frac{6}{7}$ and $\frac{2}{5}$ and $\frac{3}{10}$ added together?
9. If $\frac{7}{15}$ be taken from $\frac{3}{4}$, how much will remain?
10. If $\frac{2}{3}$ be taken from $\frac{14}{17}$, how much will remain?
11. Which is greater, $\frac{7}{18}$ or $\frac{4}{11}$?—how much greater.

SECTION 29.

1. A farmer raised $142\frac{7}{8}$ bushels of corn in one field, and $237\frac{5}{12}$ bushels in another. How many bushels did he raise in both fields?

The learner may reduce the fraction in his answer, to its lowest terms, in this, and all future examples.

2. A farm is divided into three lots;—the first lot containing $46\frac{7}{9}$ acres, the second $50\frac{3}{8}$ acres, and the third $62\frac{9}{10}$ acres. How many acres are there in the farm?

3. Add together $441\frac{4}{5}$ and $65\frac{1}{8}$ and $2556\frac{4}{13}$.

4. If $6\frac{2}{3}$ be taken from $8\frac{5}{7}$ how much will remain?

5. Subtract $437\frac{3}{4}$ from $1659\frac{2}{5}$.

6. If $6\frac{3}{8}$ gallons of wine should leak from a cask containing $53\frac{2}{9}$ gallons, how many gallons would remain?

7. Add together $623\frac{4}{5}$ and $113\frac{7}{12}$; and then subtract from the sum $450\frac{2}{7}$.

8. Three soldiers shared a loaf of bread as follows:—the first took $\frac{2}{7}$ of it, the second took $\frac{4}{13}$ of it, and the third took the remainder. What fractional part of the loaf did the third soldier receive?

9. A trader having 25 barrels of flour, sold $8\frac{4}{5}$ barrels to one man, and $9\frac{11}{12}$ barrels to another. What quantity of flour had he then remaining?

SECTION 30.

1. Suppose I have 16 dollars; to how many men can I give $\frac{2}{3}$ of a dollar apiece?

2. How many times is $\frac{2}{3}$ contained in 16?

3. How many pairs of gloves can I buy for 18 dollars, the price being $\frac{3}{4}$ of a dollar a pair?

4. Divide 18 by $\frac{3}{4}$; that is, reduce 18 to *fourths*, and find how many times 3-fourths is contained therein.

5. Divide 46 by $\frac{2}{5}$; that is, find how many times the fraction $\frac{2}{5}$ is contained in 46.

6. If a man walk 1 mile in $\frac{3}{10}$ of an hour, what distance will he walk in 4 hours?

7. How many times is $\frac{3}{10}$ contained in 4?

8. How many times is $\frac{2}{9}$ contained in $\frac{7}{8}$?

Direction. Reduce $\frac{2}{9}$ and $\frac{7}{8}$ to a common denominator and then divide one numerator by the other.

9. How many times is $\frac{3}{16}$ contained in $\frac{14}{15}$?

10. How many barrels of flour can be bought for 38 dollars, at $4\frac{7}{8}$ dollars per barrel?

11. How many times is $25\frac{6}{7}$ contained in $91\frac{2}{7}$?

12. How many times is $6\frac{5}{8}$ contained in $42\frac{1}{5}$?

Direction. Reduce the two fractions to a common denominator; then reduce the mixed numbers to improper fractions, and divide one numerator by the other.

13. If a barrel of cider will last a man $3\frac{4}{5}$ months, how many barrels will he drink in $10\frac{2}{5}$ months?

SECTION 31.

REVIEW.

1. (§ 13.) Suppose a man to earn 95 cents per day, how many days would it take him to earn $43.16?

2. (§ 14.) How many pounds of sugar can be bought for $$14\frac{5}{8}$, when the price is $\frac{1}{8}$ of a dollar a pound?

3. (§ 15.) If 1 yard of silk cord cost $\frac{1}{16}$ of a dollar, what is the price of 75 yards, at the same rate?

4. (§ 16.) If $14\frac{7}{8}$ yards of cloth be cut from a piece containing $52\frac{1}{8}$ yards, how much will be left?

5. (§ 17.) If a pound of shot cost $\frac{3}{20}$ of a dollar, what will be the cost of 17 pounds, at the same rate?

6. (§ 18.) How much corn will grow on 140 acres of land; allowing each acre to produce $34\frac{5}{8}$ bushels?

7. (§ 19.) If a man's expenses be $$46.24\frac{7}{10}$ for $\frac{1}{12}$ of a year, what will be his expenses for 1 year?

8. (§ 20.) $\frac{1}{6}$ of 71 is equal to what improper fraction? Then $\frac{1}{6}$ of 71 is equal to what mixed number?

9. (§ 21.) Suppose 42 men to share equally in a prize of $1000; what is the share of one man?

10. (§ 22.) If a man can cut 46 cords of wood in 14 days, how many cords can he cut in 60 days?

11. (§ 23.) Suppose a man can build a mile of wall in 310 days; in what time can he build $\frac{4}{7}$ of a mile?

12. (§ 24.) A man bought a quantity of flour, for domestic use, and in 36 days he found that $\frac{7}{15}$ of it was consumed. How long would the whole last?

13. (§ 25.) $\frac{2}{3}$ is equal to how many ninths? how many thirty-sixths? how many seventy-fifths?

14. (§ 26.) Reduce the two fractions, $\frac{77}{91}$ and $\frac{48}{78}$, to their lowest terms, and then add them together.

15. (§ 27.) Suppose a farm to contain $98\frac{5}{12}$ acres of and; how many acres are there in $\frac{5}{6}$ of the farm?

16. (§ 28.) Add together, $\frac{9}{10}$ and $\frac{3}{14}$ and $\frac{15}{17}$; then subtract $\frac{6}{13}$ from the sum;—what is the remainder?

17. (§ 29.) If $\frac{4}{9}$ and $\frac{6}{15}$ of a number be subtracted from itself, what part of that number is the remainder?

18. (§ 30.) If the mail-stage run $9\frac{5}{12}$ miles in 1 hour, how many hours will it be in running $175\frac{2}{7}$ miles?

RETROSPECTIVE OBSERVATIONS.

A fraction is rendered greater by increasing the numerator, and smaller by increasing the denominator.

To multiply a fraction by a whole number,—Either multiply the numerator, or divide the denominator.

To divide a fraction by a whole number,—Either divide the numerator, or multiply the denominator.

When a number is multiplied by 1, the product is equal to the multiplicand. Therefore, when a number is multiplied by a fraction, which is less than 1, the product must be less than the multiplicand.

To multiply a whole number by a fraction,—Multiply by the numerator, and divide by the denominator.

Dividing a number by 1, gives a quotient equal to the dividend. Therefore, dividing a number by a proper fraction, must give a quotient greater than the dividend, because, the fraction being less than 1, is contained a greater number of times in the dividend.

To divide a whole number by a fraction,—Multiply by the denominator, and divide by the numerator.

To multiply a fraction by a fraction,—Multiply numerator by numerator, and denominator by denominator

To divide a fraction by a fraction,—Multiply the numerator of the dividend by the denominator of the divisor, for a numerator; and multiply the denominator of the dividend by the numerator of the divisor, for a denominator

19. Multiply the fraction, $\frac{19}{732}$, by 38.
20. Divide the fraction, $\frac{8}{13}$, by 145.
21. Multiply 8706 by the fraction, $\frac{203}{464}$.
22. Divide 611 by the fraction, $\frac{7}{320}$.
23. Multiply the fraction, $\frac{168}{205}$, by the fraction, $\frac{7}{11}$.
24. Divide the fraction, $\frac{9}{24}$, by the fraction, $\frac{16}{71}$.
25. What is the product of $608\frac{4}{5}$ multiplied by $8\frac{2}{11}$?
26. What is the quotient of $45\frac{2}{7}$ divided by $3\frac{3}{4}$?

Section 32.

MISCELLANEOUS EXAMPLES.

1. Suppose a man can perform a journey in 14 days and 3 hours, travelling 9 hours a day; in what time can he perform the journey, travelling 11 hours a day?

2. A trader gave $75 for 56 gallons of wine, and lost 11 gallons by leakage. At how much per gallon must he sell the remainder, to get the whole cost?

3. Suppose a retailer to pay $165 for a ton of sugar, at what price must he sell it per pound, in order to gain 10 per cent. on the cost?

4. What quantity of salt, worth 62 cents per bushel, must be given in exchange for 258 pounds of pork, worth 9 cents per pound?

5. What is the profit on 400 hogsheads of molasses, purchased in New Orleans at $12\frac{1}{2}$ cents per gallon, [63 gal. in each hhd.], freighted to New York at $3.50 per hhd., and sold at 24 cents per gallon; 3gal. 2qt. having leaked from each hhd. on the passage?

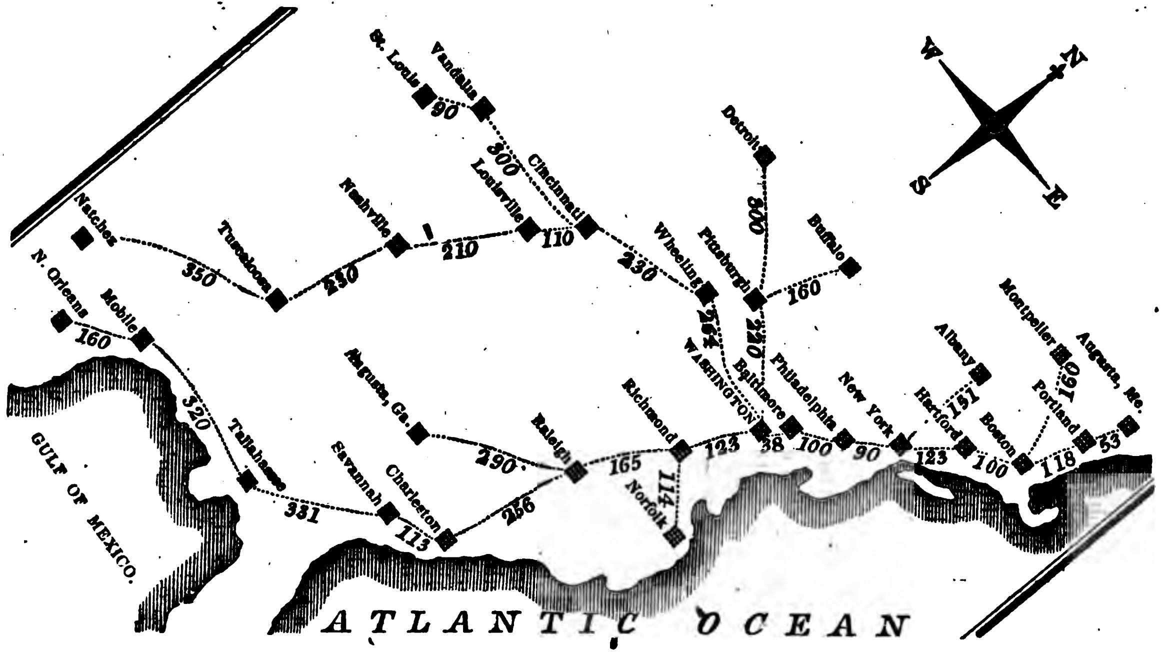
6. If a pint of rum a day will kill a man in a year and a half, how many men would a cargo of 600 hogsheads kill in the same time?

7. If 11 young men can become fools by drinking 6 bottles of wine, at $3 a bottle, what would it cost a dinner party of 25, to become fools in like manner?

8. If a man's expenses be $1.40 a day, and his income $700 a year, what will he lay up in 7 years?

9. A and B are laborers—A earns $19.50 a month, and B earns $16.25; but A gives B $\frac{2}{15}$ of his earnings. What will each lay up in 14 months?

10. Find the difference between $\frac{5}{8}$ of 91, and $\frac{7}{9}$ of 91


N
E
S
W
Augusta, Me.
53
Portland
160
Montpelier
118
Boston
100
Albany
151
Hartford
123
New York
90
Philadelphia
100
Baltimore
38
WASHINGTON
Buffalo
160
Pittsburgh
220
Detroit
300
Wheeling
264
123
Richmond
114
Norfolk
165
Raleigh
230
Cincinnati
110
Louisville
300
Vandalia
90
St. Louis
210
Nashville
230
Tuscaloosa
350
Natchez
290
Augusta, Ga.
256
Charleston
113
Savannah
331
Tallahassee
320
Mobile
160
N. Orleans
GULF OF MEXICO.
ATLANTIC OCEAN

On the opposite page, 30 cities and towns are exhibited in their respective situations, relative to each other; and the number of miles, by mail-road from town to town, is noted in figures.

11. Find the distance from Washington, through the intermediate towns, to Augusta, Me.……from Washington to Detroit……from Washington to St. Louis…… from Washington to Natchez……from Washington to New Orleans……from New Orleans to Augusta, Me.

12. Suppose a citizen in each of the places on the opposite page, to start for Washington, and travel 7 miles an hour, 10 hours in each day; how long will each one be in performing his journey?

13. How long would it take you to walk from your school-room to Washington; allowing that you could walk $3\frac{1}{2}$ miles an hour, 7 hours in each day?

14. Two men started at the same time—one of them from New Orleans, and the other from Augusta, Me.—and travelled towards each other, with equal speed. Between what two towns, and what distance from each of these towns did they meet?

15. Mr. A. went from Portland to Baltimore, travelling 5 miles an hour, and 10 hours a day. Mr. B. performed the same journey; but started 1 day later, and travelled 7 miles an hour. Where did B. pass A.?

16. Divide $1000 among A, B, and C, giving B twice as much as A, and C twice as much as B.

17. Gunpowder is composed of 5 parts sulphur, 7 parts charcoal, and 38 parts nitre. How many pounds of each ingredient, in 100 pounds of powder?

18. A and B purchased a cow for $16. A paid $9 of the price, and B paid $7. They sold the cow for $21. What was each one's share of the gain?

Solution. Since A paid $\frac{9}{16}$ of the price, and B $\frac{7}{16}$, A must have $\frac{9}{16}$ of the gain, and B $\frac{7}{16}$.

19. C and D traded in partnership; C owned $450 of the stock in trade, and D $290. They gained $146. What was each one's share of the gain?

20. Suppose $1000 stock in trade to gain $230, what is the gain on $351 of that stock?

21. E and F purchased 245 acres of land, for $2600 E paid $1200 of the money, and F paid the remainder How much land should each one have?

22. The national debt of England is not less than $1 900 000 000. Allowing 5 per cent. interest to be paid on this sum, how many families would it support, each family spending $400 per annum?

23. If a man can dig a trench in 15 days, and a boy can dig the same trench in 18 days, in what time can they both dig it? (See example 20, Oral sec.)

24. How many days will it take 17 men to perform a piece of work, that 1 man can perform in 95 days?

25. How many days will it take 30 men to perform a piece of work, that 4 men can perform in 50 days?

26, How many days will it take 25 men to perform a piece of work, that 6 men can perform in 40 days?

27. If 15 yards of carpeting, which is one yard wide, will cover the floor of a room, how many yards of carpeting, 3-quarters wide will cover the same floor?

Direction. Find the number of square quarters contained in 15 yards of the wider carpeting; then divide this number, by the number of square quarters contained in one yard of the narrower carpeting.

28. Suppose $3\frac{1}{2}$ yards of broad-cloth 5-quarters wide, to be made into a cloak; how many yards of silk 3-quarters wide, will it take to line the cloak?

29. How many yards of carpeting that is 5-quarters wide, will cover the floor of a room which is $19\frac{1}{2}$ feet in length, and 15 feet in width?

30. How many bricks will it take to build a wall, 1 foot thick, 5 feet high, and 24 feet long; each brick being 8 inches long, 4 inches wide, and 2 inches thick?

31. If a man can hoe $\frac{7}{12}$ of an acre of corn in a day, and a boy $\frac{1}{5}$ of an acre, how much can they both hoe in a day? In what time can they both hoe 9 acres?

32. There is a cistern, having 3 pipes; the first pipe will discharge the cistern in 4 hours, the second in 5 hours, the third in 6 hours. What part of the contents of the cistern would all the pipes together let off in 1 hour. In what time would they all discharge the cistern?

33. What is the height of a steeple, whose shadow is 148 feet 4 inches, when a shadow 5 feet 4 inches long is projected from a post 6 feet 4 inches high?

34. A trader failed in business, owing $11000, and having only $5000 to divide among his creditors. How much did he pay on a debt of $95.20?

35 A fox has 50 rods the start of a greyhound, but the hound runs 15 rods while the fox runs 9½. How many rods must the hound run, to catch the fox?

36. A cubic foot of air weighs 1¼ ounce. How many pounds of air does a room contain, which is 16 feet long, 14 feet wide, and 10 feet high?

37. What number must that be, which, being increased by its half, and its third, becomes 88?

38. A and B hired a pasture for $30. A turned in 3 cows, and B turned in 12 sheep. Allowing 5 sheep to be equal to 1 cow, what must each pay?

39. Suppose London has 1 500 000 inhabitants, New York 350 000, Philadelphia 220 000, New Orleans 115 000, Baltimore 110 000, and Boston 105 000; how many times greater is London, than each of the others?

When a scholar has reached this point, it will be well to consider how much more time he is likely to devote to study. If he have but a few months more to spend in school, the SUPPLEMENT will furnish for him the suitable exercises, with which to finish his course of study in arithmetic. If, however, he is likely to continue at school for several years, he may omit the Supplement, and enter immediately upon the exercises of PART THIRD.

In the preceding chapters, departments of business are not arranged under distinct heads. The arrangement is strictly *arithmetical*, and business examples are made incidental to the course. In the Supplement, departments of business are separately presented, in distinct articles. These articles, although brief, are rendered sufficient, by the learner's previous familiarity with the operations they require.

SUPPLEMENT

ARTICLE I.

INDICATIVE CHARACTERS [illegible] SIGNS.

$+$ (*Plus*,) standing between numbers, indicates that they are to be added together; thus, $3+2$ is 5.

$-$ (*Minus*,) indicates that the number after it is to be subtracted from the number before it; thus, $5-2$ is 3.

$\times$ (*Into*,) indicates that one number is to be multiplied into another; thus, 4×3 is 12.

$\div$ (*By*,) indicates that the number on the left is to be divided by the number on the right; thus, $12\div 3$ is 4.

$=$ (*Equal to*,) indicates that the number before it is equal to the number after it; for example, $4+2=6$. $6-2=4$. $5\times 3=15$. $15\div 3=5$.

CANCELLATION OF FACTORS.

THE CANCELLATION OF FACTORS is the excluding of such factors from an operation as balance each other.

Any two equal factors, one being a factor of a dividend, and the other a factor of the divisor, or, one a factor of a numerator, and the other of the denominator, may be *cancelled*, that is, *crossed and omitted*. For example, $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{1}{2}$ is reduced to a simple fraction, as follows —

Here we cancel the two *threes*, and multiply 1 by 1, and 4 by 2.

$$\frac{1\quad \cancel{3}\quad 1}{\cancel{3}\quad 4\quad 2} = \frac{1}{8}$$

When one of two opposite factors will divide the other without a remainder, both may be cancelled, and the quotient retained in the place of the factor divided. For instance, let us find what is $\frac{3}{5}$ of $\frac{4}{9}$ of $\frac{10}{11}$ of $\frac{1}{4}$ of 20.

$$\frac{\cancel{3}\quad \cancel{4}\quad \overset{2}{\cancel{10}}\quad 1\quad 20}{\cancel{5}\quad \underset{3}{\cancel{9}}\quad 11\quad \cancel{4}\quad 1} = \frac{40}{33} = 1\tfrac{7}{33}\ \textit{Ans.}$$

1. Reduce $\frac{5}{8}$ of $\frac{3}{5}$ of $\frac{16}{17}$ of $\frac{2}{3}$ to a simple fraction.
2. What is $\frac{7}{8}$ of $\frac{6}{7}$ of $\frac{4}{5}$ of $\frac{15}{16}$ of $\frac{7}{15}$ of $\frac{1}{6}$ of 100?
3. Reduce $\frac{2}{9}$ of $\frac{5}{8}$ of $\frac{4}{5}$ of $\frac{9}{10}$ to a simple fraction.

When all of a term is cancelled off, the new term must be 1

4. A merchant owning $\frac{1}{2}$ of $\frac{7}{9}$ of $\frac{2}{7}$ of a ship, sold $\frac{2}{3}$ of his share. What part of the ship did he sell?

5. 3 men owned equally a saw-mill; one sold $\frac{5}{8}$ of $\frac{3}{4}$ of $\frac{2}{5}$ of his share. What part of the mill did he sell?

II.

DECIMAL FRACTIONS.

A DECIMAL FRACTION is a fraction whose denominator is 10, or 100, or 1000, &c. The denominator of a decimal fraction is never written: the numerator is written with a point prefixed to it, and the denominator is understood to be a 1, with as many ciphers annexed as there are figures in the numerator. Thus, .3 is $\frac{3}{10}$; .31 is $\frac{31}{100}$; .316 is $\frac{316}{1000}$; .3164 is $\frac{3164}{10000}$.

1. Write upon the slate, the decimals expressing the following fractions. $\frac{3}{10}$. $\frac{46}{100}$. $\frac{708}{1000}$. $\frac{1642}{10000}$. $\frac{96041}{100000}$.

When a whole number and a decimal are written together, the decimal point is placed between them. Thus, 24.6 is $24\frac{6}{10}$; 5.71 is $5\frac{71}{100}$; 48.364 is $48\frac{364}{1000}$.

2. Write the following mixed numbers, expressing the fractions decimally. $38\frac{5}{10}$. $516\frac{22}{100}$. $8\frac{354}{1000}$. $24\frac{7636}{10000}$.

In whole numbers, any figure, wherever it may stand, expresses a quantity $\frac{1}{10}$ as great as it would express, if it were written one place further to the left. For instance, in the number 1111, the 1 hundred is $\frac{1}{10}$ of a thousand; the 1 ten is $\frac{1}{10}$ of a hundred, or $\frac{1}{100}$ of a thousand; the 1 unit is $\frac{1}{10}$ of a ten, or $\frac{1}{1000}$ of a thousand. In decimals, this system is continued below the place of units.

For example, in the number 1.111, the 1 next to the right of the unit is 1-*tenth*, that is, $\frac{1}{10}$ of a unit; the 1 next to the right of the 1-tenth is $\frac{1}{10}$ of a tenth, or 1-*hundredth* of a unit; the one next to the right of the 1-hundredth, is $\frac{1}{10}$ of a hundredth, or 1-*thousandth* of a unit.

one unit.	one tenth.	one hundredth.	one thousandth.
1.	1	1	1

Ciphers placed on the right hand of decimal figures, do not alter the value of the decimal; because, the figures remain unchanged in their distance from the unit's place. For instance, .5, .50, and .500 are of equal value; being each equal to $\frac{1}{2}$. But every cipher placed on the left of a decimal, renders it ten times smaller, by removing the figures one place further from the unit's place. Thus, if we prefix one cipher to .5, it becomes .05 [$\frac{5}{100}$]; if we prefix two ciphers, it becomes .005 [$\frac{5}{1000}$]; and so on.

3. Write upon the slate, decimals expressing the following fractions. $\frac{4}{100}$. $\frac{7}{1000}$. $\frac{3}{10000}$. $\frac{6}{100000}$. $\frac{8}{1000000}$.

TO READ DECIMAL FRACTIONS,—*Enumerate and read the figures, as if they were whole numbers, and conclude by pronouncing the name of the lowest denomination.*

4. Copy upon the slate, and read the following decimals.

.06	.065	.0007	24.02
.008	.409	.06264	5.763084
.013	.207862	.10809	160.052
.0514	.5004	.6500171	712.3005

5. Write in decimals the following mixed numbers.

$9\frac{6}{100}$	$46\frac{51}{1000}$	$12\frac{16}{10000}$	$60\frac{8}{1000}$
$8\frac{14}{1000}$	$7\frac{305}{10000}$	$200\frac{6}{1000}$	$8\frac{40607}{1000000}$
$3\frac{101}{1000}$	$65\frac{7}{1000}$	$1\frac{4006}{10000}$	$26\frac{15}{10000000}$

ADDITION OF DECIMALS.

6. Add the following numbers into one sum. 63.75 and 524.0764 and .23 and 261.803.

```
   63.75
  524.0764
     .23
  261.803
 ---------
  849.8594
```

In arranging decimals for addition, we place tenths under tenths, hundredths under hundredths, &c. We then begin with the lowest denomination, and proceed to add the columns as in whole numbers.

7. What is the sum of 2.164, 870.31, 756, 9.18, 157.0008, 26.104, and .3728?

8. What is the sum of 2706, 58.2, .2065, 6.441, 75, 14.2, and 990.752?

In Federal Money, the dollar is the unit; that is, dollars are whole numbers; dimes are tenths, cents are hundredths, and mills are thousandths. See page 124.

9. Add together $24.6, $9.07, $5.009, and 5 cents.

10. Write the following sums of money in the form of decimals, and add them together. $46 and 9 cents, 14 cents, $7 and 8 mills, 6 dimes, 8 dimes and 7 mills.

SUBTRACTION OF DECIMALS.

11. Subtract 52.6087 from 406.91.

406.91
52.6087
354.3013

After placing tenths under tenths &c., we subtract as in whole numbers. The blank places over the 7 and 8, are viewed as ciphers.

12. Subtract 943.076 from 8270.54.

13. Subtract 1084.72 from 5608.0626.

14. Subtract 146.1706 from 16094.

15. Find the difference between .8 and .08, by subtracting the smaller decimal from the greater.

16. Find the difference between .45 and .31067.

17. What is the difference between 1 and .046?

18. Write 4 dollars and 8 mills in decimal form, and subtract therefrom, 6 dimes and 5 mills.

19. Subtract 7 cents and 3 mills from 10 dollars.

MULTIPLICATION OF DECIMALS.

Multiplying by any fraction, is taking a certain part of the multiplicand for the product; consequently, multiplying one fraction by another, must produce a fraction smaller than either of the factors. For example, $\frac{9}{10}$ multiplied by $\frac{8}{10}$ is $\frac{72}{100}$, or, decimally, .9 multiplied by .8 is .72. Hence you may observe, that the number of decimal figures in any product, must be equal to the number of decimal figures in both the factors.

20. Multiply 531 by .52. 65.7 by .43 7.06 by .24. .439 by .38. .149 by .26.

531	65.7	7.06	.439	.149
.52	.43	.24	.38	.26
1062	1971	2824	3512	894
2655	2628	1412	1317	298
276.12	28.251	1.6944	.16682	.03874

RULE FOR MULTIPLICATION OF DECIMALS. *Multiply as in whole numbers; and in the product, point off as many figures for decimals, as there are decimal places in both factors. If the number of figures in the product be less than the number of decimal places in both factors, prefix ciphers to supply the deficiency.*

21. Multiply 1608 by .4,—that is, find .4 of 1608.
22. Multiply .45 of a dollar by 8.
23. How much is 36 times .495 of a dollar?
24. What cost 18 yards of cloth, at $4.072 per yd.?
25. What cost 28.7 yards of cloth, at $9 per yd.?
26. What cost 9.3 acres of land, at $8.41 per acre?
27. If 1 yard of silk cord cost 7 mills, [.007], what is the price of .9 of a yard?
28. What is 6 per cent. or .06 of 340.4?
29. Multiply 42.863 by 70.28.
30. Multiply 2046 by .932.
31. Multiply .7253 by .0423.
32. Multiply 6.5431 by .402.
33. What is the product of .04 multiplied by .07?
34. What is the product of .005 by .009?
35. Multiply 7 and 5-hundredths by 6-thousandths.

DIVISION OF DECIMALS.

RULE FOR DIVISION OF DECIMALS. *Divide as in whole numbers; and in the quotient, point off as many figures for decimals, as the decimal places in the dividend exceed those in the divisor; that is, make the decimal places in the divisor and quotient counted together, equal to the decimal places in the dividend.*

If there be not figures enough in the quotient to point off, prefix ciphers to supply the deficiency.

When there are more decimal places in the divisor, than in the dividend, render the places equal, by annexing ciphers to the dividend, before dividing.

After dividing all the figures in the dividend, if there be a remainder, ciphers may be annexed to it, and the division continued. The ciphers thus annexed, must be counted with the decimal places of the dividend.

36. Divide 64.395 by 40.5. **Divide 5.8674 by 127**

40.5)64.395(1.59
405
2389
2025
3645
3645

127)5.8674(.0462
508
787
762
254
254

37. Divide 2033.1 by .324. Divide 1383.2 by 60.8

.324)2033.100(6275
1944
891
648
2430
2268
1620
1620

60.8)1383.2(22.75
1216
1672
1216
4560
4256
3040
3040

38. How many times is .27 contained in 1.224?

.27)1.224(4.533+
108
144
135
90
81
90
81
9

The sign of *addition*, or *more*, here shows, that the true quotient is more than the preceding figures express. We might continually annex ciphers to this remainder, and carry on the division, but we should never arrive at a complete quotient. For the purposes of business, it is seldom necessary to extend the quotient below thousandths.

39. How many times is 1.23 contained in 3021.741?
40. How many times is 1243.4 contained in 5.37148?
41. How many times is .204 contained in 77112?
42. How many times is 4.2 contained in 194.334?
43. How many times is 30.02 contained in 94.657?
44. How many times is .44 contained in 1606?
45. What is the quotient of 42.65 divided by 36?
46. What is the quotient of .8 divided by 8?

CHANGE OF COMMON FRACTIONS TO DECIMALS.

RULE. *Annex ciphers to the numerator, and divide it by the denominator: the quotient will be the decimal.*

47. Change $\frac{7}{12}$ to a decimal.

$$\begin{array}{r} 12)\underline{7.0000} \\ .5833+ \end{array}$$

By annexing four ciphers, we obtain four decimal figures. We might, however, annex more ciphers, and carry the decimal still lower.

48. Change $\frac{1}{2}$ to a decimal.

49. Change the following fractions to their respective decimals. $\frac{2}{3}$. $\frac{1}{4}$. $\frac{3}{4}$. $\frac{13}{20}$. $\frac{5}{18}$. $\frac{5}{12}$. $\frac{14}{37}$. $\frac{26}{375}$.

50. Change $\frac{9}{16}$ of a dollar to a decimal; that is, find how many cents and mills there are in $\frac{9}{16}$ of a dollar.

51. Change 48\frac{5}{7}$ to a decimal expression.

52. Change £316$\frac{15}{24}$ to a decimal expression.

CHANGE OF COMPOUND NUMBERS TO DECIMALS.

To reduce the lower denominations of a compound number to the decimal of a higher denomination.

RULE. *Reduce the given quantity to a common fraction, then change this fraction to a decimal.* See page 171.

53. Reduce 7s. 6d. to the decimal of a £.
54. Reduce 15 shillings to the decimal of a £.
55. Reduce 6d. 3qr. to the decimal of a shilling.
56 Reduce 2s. 11d. 3qr. to the decimal of a £.
57. Reduce 1 farthing to the decimal of a shilling.
58. Reduce £18 2s. 7d. to a decimal expression.
59. Reduce 14dwt. 18gr. to the decimal of an oz. Troy.
60. Reduce 4qt. 1pt. to the decimal of a bushel.
61. Reduce 3qt. 1pt. 2gl. to the decimal of a gallon.
62. Reduce 10r. 3yd. 2ft. to the decimal of a mile.
63. Express 29yd. 2qr. 3na. of cloth decimally, and find its cost, at $7.625 per yard.

CHANGE OF DECIMALS TO COMPOUND NUMBERS.

To reduce the decimal, of a higher denomination, to its value in whole numbers of lower denomination.

RULE. *Multiply the decimal by that number of the next* *lower denomination, which makes a unit of the higher, and the product will be of the lower denomination. Proceed thus with the decimal in each succeeding product.*

64. Reduce .6526 of a £ to its value in shillings, &c.

```
  .6526
     20
-------
13.0520
     12
-------
  .6240
      4
-------
 2.4960
```

We multiply the decimal of a £ by 20, to find the shillings, because there are 20 times more shillings than pounds in any sum, whether the sum be a whole number or a decimal The same reasoning also applies, in finding the pence, and the farthings. *Answer*, 13s. 0d. 2qr.+

65. Reduce .4039 of a £ to its value in shillings, &c.

66. Reduce .857 of a shilling to pence and farthings.

67. Reduce .76 of a ton to cwt. qr. lb. &c.

68. In .2094 of a day, how many hours, minutes, &c.?

69. In .57 of an acre, how many roods, rods, &c.?

70. Reduce £15.2908 to its proper expression in pounds, shillings, pence, and farthings.

EXCHANGE OF CURRENCIES.

In New England, Virginia, Kentucky, and Tennessee, $\frac{1}{6}$ of a dollar is called a shilling.

In New York and North Carolina, $\frac{1}{8}$ of a dollar is called a shilling.

In Pennsylvania, New Jersey, Delaware, and Maryland, $\frac{2}{15}$ of a dollar is called a shilling.

In South Carolina and Georgia, $\frac{3}{14}$ of a dollar is called a shilling.

In Canada, $\frac{1}{5}$ of a dollar is called a shilling.

In Great Britain, the shilling, of the Sterling currency, is equal to $\frac{2}{9}$ of a dollar.

71. How many cents and mills, that is, what decimal of a dollar, in a New England shilling? in 2 shillings? in 3 shillings? in 4 shillings? in 5 shillings?

```
6)1.000     6)2.000
  .166⅔       .333⅓
```

$\frac{1}{6}$ of the number expressing shillings, expresses an equal value in decimals of a dollar

72. How many cents and mills in a New York shilling? in 2s.? in 3s.? in 4s.? in 5s.? in 6s.? in 7s.?

73. How many cents and mills in a Pennsylvania shilling? in 2s.? in 3s.? in 4s.? in 5s.? in 6s.?

$$1\times\frac{2}{15}=.133\frac{1}{3} \qquad 2\times\frac{2}{15}=.266\frac{2}{3}$$

74. How many cents and mills in a Georgia shilling? in 2s.? in 3s.? in 4s.?

75. How many cents and mills in a Canada shilling? in 2s.? in 3s.? in 4s.? in 5s.?

76. How many cents and mills in a shilling, Sterling, of Great Britain? in 2s.? in 3s.? in 4s.?

To change the currencies of pounds, shillings and pence of every variety of value, to Federal money.

RULE. *Reduce the pounds, if there be any, to shillings. Denote the shillings as units, reduce the pence and farthings to the decimal of a shilling, and multiply the sum by that fraction of a dollar which is equal to one shilling.*

77. Change 13s. 6d., of the old currency of New England, to Federal money.

$$13\text{s. }6\text{d.}=13.5\text{s.} \qquad 13.5\times\frac{1}{6}=2.25.$$

78. Change £42 19s. 4$\frac{1}{2}$d., of the old currency of New England, to Federal money.

$$£42\ 19\text{s. }4\frac{1}{2}\text{d.}=859.375\text{s.}$$

79. Change 13s. 6d., of the old currency of New York, to Federal money.

80. Change £25 17s. 8$\frac{3}{4}$d., of the old currency of New York, to Federal money.

81. Change 18s. 11d., of the old currency of Pennsylvania, to Federal money.

82. Change £14 7s. 6$\frac{1}{2}$d., of the old currency of Pennsylvania, to Federal money.

83. Change 16s. 10d., of the old currency of Georgia, to Federal money.

84. Change £54 12s. 11$\frac{1}{4}$d., of the old currency of Georgia, to Federal money.

85. Change £21 9s. 3$\frac{3}{4}$d., of the currency of Canada, to Federal money.

86. Change £5 12s. 4d. Sterling, of Great Britain, to Federal money

III.

PERCENTAGE.

Percentage has already been explained in page 163. Since per cent. indicates *hundredths*, it is properly expressed in the first and second decimal places, taken together. Thus, 6 per cent. is .06; 12 per cent. is .12. A fraction of 1 per cent. is expressed in decimals lower than hundredths. Thus, ½ per cent. is .005; ¼ per cent. is 0025; 6½ per cent. is .065; 12¾ per cent. is .1275.

Multiplying by a decimal, produces such a part of the multiplicand, as the decimal indicates. Therefore,—

To find the Percentage on any sum,—*Multiply the sum by the decimal which denotes the rate per cent.*

1. A merchant having $1426 in the bank, drew out 5 per cent. of it. What sum did he draw?

$$\begin{array}{r} 1426 \\ .05 \\ \hline \$71.30 \\ \hline \end{array}$$

Since 5 per cent. of any quantity is $\frac{5}{100}$ of that quantity, the question in this example is What is $\frac{5}{100}$ of 1426 dollars? Or, decimally, What is .05 of 1426 dollars?

2. What is 1 per cent. of $100? of $834?
3. What is 3 per cent. of $100? of $42?
4. What is 7 per cent. of $100? of $1085?
5. What is 9 per cent. of 354 dollars?
6. What is 24 per cent. of 1852 dollars?

When the rate is a fraction of 1 per cent.—*First, reduce the rate to a decimal, by multiplying* .01 *by the fraction. Then multiply by the decimal rate as before.*

7. What is ¾ per cent. of 234 dollars?

$.01 \times \frac{3}{4} = .0075$. Then $234 \times .0075 = 1.755$.

8. What is ¼ per cent. of 524 dollars?
9. What is ⅘ per cent. of 190 dollars?
10. What is 2½ per cent. [.025] of 50 dollars?
11. What is 6¼ per cent. of 75 dollars?
12. What is 10¾ per cent. of 200 dollars?

13. Find $7\frac{1}{3}$ per cent. of 344 dolls.

When there is a fraction in the rate per cent. which cannot be exactly expressed by a decimal—as in this example—we first find 1 per cent. of the given sum, by dividing it by 100, and then multiply this quotient by the mixed number that expresses the rate.

$$\begin{array}{r} 344 \div 100 = 3.44 \\ 7\frac{1}{3} \\ \hline 2408 \\ 114\frac{2}{3} \\ \hline \$25.22\frac{2}{3} \end{array}$$

14. What is $4\frac{1}{3}$ per cent. of 624 dollars?
15. What is $6\frac{2}{3}$ pėr cent. of 38 dollars?
16. What is $3\frac{1}{4}$ per cent. of 2310 dollars?
17. What is $9\frac{1}{6}$ per cent. of 17 dollars?

18. What is 7 per cent. of 24 dolls. 32 cts.?

Here we have cents [decimals] in the number on which the percentage is to be taken. We however multiply as usual in decimals, and the first two decimal figures in the product express cents, the third mills, the fourth *tenths* of a mill.

$$\begin{array}{r} 24.32 \\ .07 \\ \hline \$1.7024 \end{array}$$

19. What is 14 per cent. of \$641.94?
20. What is $4\frac{1}{5}$ per cent. of \$37.26?
21. What is $11\frac{1}{3}$ per cent. of \$150.75?

To find what per cent. a smaller number is of a larger,—*Consider the smaller number as a numerator, and the larger as a denominator of a fraction; then reduce this fraction to a decimal.* See page 188.

22. If a man, having \$94 deposited in bank, draw out \$25, what per cent. of his deposit does he draw?

25 is $\frac{25}{94}$ of 94. Then $\frac{25}{94} = .26\frac{56}{94}$. Ans. $26\frac{28}{47}$ per cent

23. What per cent. of 240 dollars is 32 dollars?
24. What per cent. of 12 dollars is 7 dollars?
25. What per cent. of \$95.21 (9521 cts.), is \$4.22?

To find a percentage of a compound number,—*Multiply by the rate per cent., as a whole, or mixed number, and divide the product by* 100, *or the factors of* 100.

26. What is 6 per cent. of £22 10s. 9d.?
27. What is 4 per cent. of £41 15s. 6d.?
28. What is $3\frac{1}{2}$ per cent. of £8 16s. 8d.?

COMMISSION.

Commission is the compensation made to factors and brokers for their services in buying or selling. It is reckoned at so much per cent. on the money employed in the transaction.

29. What is the commission on $500, at 2½ per cent.?
30. If I allow my factor a commission of 3 per cent. for disbursing 725 dollars 50 cents, on my account, what does his commission amount to?
31. How much does a broker receive for his services on a sale of stocks amounting to 52648 dollars, allowing his commission to be ¼ of 1 per cent.?

STOCKS.

Stock is a property, consisting in shares of some establishment, designed to yield an income. It includes government securities, shares in incorporated banks, insurance offices, factories, canals, rail-roads, &c.

The *par* value of a share, is what it originally cost; and the *real* value, at any time, is what it can be sold for. When it will sell for more than it originally cost, it is said to be *above par*, and the excess is stated at so much per cent. *advance*. When its real value is less than the original cost, it is *below par*, and is sold at a discount.

32. Sold 10 shares in the Manufacturers' Insurance Company, at 5 per cent. advance, the par value of a share being 100 dollars. How much did I receive?
33. Bought 15 shares in the Boston Bank, at ¾ of 1 per cent. advance, the par value being 50 dollars a share. How much did I give for them?
34. Sold 64 shares in the State Rail-road, at 1¼ per cent. discount, the par value being 100 dollars a share. How much did I receive for them?

INSURANCE.

Insurance is security given, to restore the value of ships, houses, goods, &c., which may be lost at sea, or by fire. The security is given in consideration of a *premium* paid by the owner of the property insured. This premium is a percentage on the value of the property.

The written instrument, which is the evidence of the contract of indemnity, is called a *policy*.

35. What is the amount of premium for insuring 19416 dollars, at 2 ½ per cent., on a ship from Liverpool?

36. I effected an insurance of 3460 dollars on my dwelling-house for one year, at ⅜ of 1 per cent. What did the premium amount to?

37. If you obtain an insurance on goods valued at $ 7325, at ½ of 1 per cent., what will the premium amount to?

IV.

INTEREST.

INTEREST has already been defined, and rules for computing it without decimals have been given, in Chap. VI., Sect. 23. The rules are repeated in this article, with such modifications as provide for the use of decimals.

To compute interest for one or more YEARS.

RULE. *Multiply the principal by the decimal that expresses the rate, and the product will be the interest for 1 year. Multiply the interest for one year by the number of years.*

1. Find the interest of $ 87.41, for 3 years, at 6 per cent

$87.41 \times .06 \times 3 = 15.7338$. *Ans.* $ 15.73+

In the answers, fractions of a cent may be omitted.

2. Find the interest of $ 644, for 4 years, at 6 per cent.

3. Find the interest of 92 cents, for 7 years, at 6 per cent.

4. Find the interest of $ 7.50, for 2 years, at 4 per cent.

5. Find the interest of $ 2.91, for 3 years, at 4 ½ per cent.

6. Find the interest of $ 9.53, for 4 years, at 5 ¾ per cent

7. What is the interest of $ 752.25, for 3 years, at 5 per cent.? What is the amount?

8. What is the interest of £ 16 8s. 6d., for 1 year, at 6 per cent.? What is the amount?

To compute interest when there are MONTHS in the time.

RULE. *First find the interest for the years, if there be any. Then take* $\frac{1}{12}$ *of a year's interest for* 1 *month;* $\frac{2}{12}$ *or* $\frac{1}{6}$ *for* 2 *months;* $\frac{3}{12}$ *or* $\frac{1}{4}$ *for* 3 *months; and so on.*

9. What is the interest of 224 dollars for 7 months, at 6 per cent. per annum?

10. What is the interest of 75 dollars and 50 cents, for 5 months, at 6 per cent.?

11. What is the interest of 145 dollars, for 1 year and 3 months, at 6 per cent.?

12. What is the interest of 95 dollars and 25 cents, for 2 years and 8 months, at 5 per cent.?

13. What is the interest of $351.09, for 3 years and 9 months, at 7 per cent.? What is the amount?

To compute interest, when there are DAYS in the time.

RULE. *First find the interest for the years and months, if there be any. Then take* $\frac{1}{30}$ *of a month's interest for* 1 *day;* $\frac{2}{30}$ *or* $\frac{1}{15}$ *for* 2 *days;* $\frac{3}{30}$ *or* $\frac{1}{10}$ *for* 3 *days; and so on.*

14. What is the interest of $ 1000 for 1 year, 1 month and 1 day, at 6 per cent.?

15. What is the interest of $ 356.75 for 8 months and 10 days, at 6 per cent.?

16. What is the interest of $ 76.81 for 5 years, 2 months and 18 days, at 4 per cent.?

17. What is the interest of $ 250 for 1 year and 29 days, at 6 per cent.? What is the amount?

18. What is the amount of $ 92.86 for 3 years, 7 months and 14 days, at 7 per cent.?

19. What is the interest of $ 175.63, from May 19, 1842, to January 4, 1844, at 6 per cent.?

We find the time between the two dates by subtracting the first from the last, as in compound subtraction; the months being denoted numerically.

1844	1	4
1842	5	19
1	7	15

20. What is the interest of $208.90, from June 2, 1843, to August 4, 1845, at 5½ per cent.?

21. What is the interest, at 6 per cent., on a note of $110, dated Sept. 7, 1843, and paid July 9, 1846? What is the amount?

PARTIAL PAYMENTS.

In the settlement of notes, which have been partly paid, at dates previous to the settlement, the common method of computing the interest operates justly in cases where interest has not been running for more than one year. But for longer periods of interest, this method is not strictly just to the creditor, and ought not to be adopted.

THE COMMON METHOD. *Compute the interest on the original debt, from the date when interest commenced to the date of the settlement; also, compute the interest on each payment, from the date of the payment, to the date of the settlement. Then, subtract the amount of all the payments from the amount of the original debt, and the remainder will be the balance due.*

The United States' Court, and the Courts of the several States, in which decisions have been reported—with the exception of Connecticut, Vermont, and New Jersey—have established a uniform legal rule for the computation of interest, when partial payments have been made.

THE LEGAL RULE. *Compute the interest on the principal of the note to the earliest date when a payment was made, which, either alone, or together with preceding payments, exceeds the interest then due. Add this interest to the principal, and from the sum subtract the payment or payments thus far made. The remainder becomes a new principal, with which proceed as with the principal of the note.*

(22.) Boston, January 14th, 1843.

For value received, I promise to pay Wm. Rich, or order, one hundred and forty-one dollars and eight cents, in three months, with interest after. John Lang.

On the back of this note were the following endorsements. May 1st, 1843, received seventy-five dollars. September 14th, 1843, received forty-five dollars. What is the balance Jan. 14th, 1844, the interest being 6 per cent., computed by *the common method?*

First payment,	$75.	2nd payt.	$45.	Principal,	$141.08
Int., 8 m. 14 d.,	3.17	Int., 4 m.	.90	Int., 9 m.	6.34
Amount,	$78.17	Amount,	$45.90	Amount,	147.42
			78.17		124.07
Amount of payments,			$124.07	Balance	$23.35

(23.) New York, May 25th, 1843.

For value received, I promise Joseph Day to pay him or order, the sum of three hundred and one dollars and forty-seven cents, on demand, with interest.

Attest, John Smith. Samuel French.

On the back of this note, the following endorsements were made. July 1st, 1843, received sixty-seven dollars and fifty cents. January 4th, 1844, received forty-eight dollars. April 11th, 1844, received thirty-nine dollars. What is the balance, June 21st, 1844; interest being 6 per cent., computed by the common method?

(24.) Philadelphia, March 4th, 1842.

For value received, I promise to pay to the order of Harper & Jones, one thousand two hundred dollars, on demand, with interest. Charles Train.

The following endorsements are on this note. June 10th, 1842, received one hundred sixty-nine dollars and twenty cents. Oct. 22d, 1842, received twenty dollars. March 30th, 1843, received twenty-eight dollars. Nov. 5th, 1843, received six hundred eighteen dollars and five cents. If 6 per cent. interest be computed by the legal rule, what is the balance due, March 5th, 1844?

Principal,		$1200.
Interest from Mar. 4, to June 10, (3 m. 6 d.),		19.20
First Amount,		1219.20
First payment,		169.20
Balance, forming a new principal,		1050.00
Interest from June 10, to Oct. 22, (4 m. 12 d.),	$23.10	
Second payment,	20.	
Leaving interest unpaid,	3.10	
Interest from Oct. 22, to Mar. 30, (5 m. 8 d.),	27.65	
	30.75	
Third payment,	28.00	
Leaving interest unpaid,	2.75	
Interest from Mar. 30, to Nov. 5, (7 m. 6 d.),	37.80	40.55
Second Amount,		1090.55
Fourth payment,		618.05
Balance, forming a new principal,		472.50
Interest from Nov. 5, to Mar. 5, (4 m.),		9.45
Balance due on taking up the note,		$481.95

(25.) New Orleans, January 1, 1841.

For value received, I promise to pay William Lock or order, one thousand dollars, on demand, with interest, 6 per cent. Edward Smith.

Five partial payments are endorsed on Smith's note: viz. Feb. 1st, 1842, received seventy-five dollars. June 1st, 1842, received twenty dollars. August 1st, 1843, received twenty dollars. October 1st, 1843, received seven hundred and fifty dollars. Feb. 1st, 1844, received one hundred dollars. The balance of this note was paid June 1st, 1844. How much was it, by the legal rule?

COMPOUND INTEREST.

Compound Interest is that which is paid not only for the use of the principal, but also for the use of the interest after it becomes due. The *period* of interest, that is, the term of time at the end of which interest is due, may be a year, a quarter, or any other term agreed upon. Whatever be the period, the following rule is applicable.

RULE. *Find the amount for the first period, and consider it the principal for the second period; find the amount for the second period, and consider it the principal for the third period; and thus proceed through the whole number of periods. Subtract the first principal from the last amount, and the remainder will be the compound interest.*

26. What is the compound interest of $100 for 3 years at 6 per cent.; the interest being due annually?

1st year.	2nd year.	3rd year.	Answer.
100	106	112.36	119.10+
.06	.06	.06	100
6.00	6.36	6.7416	$19.10+
100	106	112.36	
106.00	112.36	119.1016	

27. What is the compound interest of 355 dollars, for 6 years, at 6 per cent. per annum?

28. What is the compound interest of 250 dollars, for 4 years, at 7 per cent. per annum?

29. To what sum will 450 dollars amount, in 5 years, at 5 per cent. per annum, compound interest?

30. At compound interest, what will 600 dollars amount to in 1½ year, at the rate of 6 per cent. a year, interest payable quarterly?

V.

DISCOUNT.

Discount is sufficiently defined in page 168; and we have now only to apply decimals to the operations.

RULE. *Divide the debt by the amount of* 1 *dollar for the time, and the quotient is the present worth. Subtract the present worth from the debt, and the remainder will be the discount.*

1. What is the present worth of 125 dollars, due in 18 months, when interest is 6 per cent. per annum?

$1 amounts to $1.09. $125 \div 1.09 = 114.66+$

2 What is the present worth of $456, due in 15 months, when money is worth 5 per cent. per annum?

3. What is the discount on 3465 dollars for 6 months, when interest is 7 per cent. a year?

4. What is the present value of a note for 2448 dollars and 50 cents, payable in 8 months, when interest is 6 per cent. per annum?

VI.

BANKING.

The interest on money hired from a bank is paid when the money is taken out. That is, the bank computes the interest on the principal of the note it receives, to the time the note is to be paid, deducts this interest from the principal, and advances the remainder to the hirer. Hence, bank interest is called *discount;* and the note received by the bank is said to be *discounted.*

Bank discount is always computed for three days—called *days of grace*—more than the time stated in the note for payment; and the hirer is not required to pay until the last of these three days.

1. Find the bank discount on $585 for 60 days and grace, ($2\frac{1}{10}$ months,) at the rate of 6 per cent. a year.

2. What is the bank discount on 900 dollars for 90 days, and grace, at the rate of 6 per cent. a year?

3. How much is received on a note for 2540 dollars 80 cents, payable in 4 months, and grace, discounted at a bank, when interest is 4½ per cent. a year?

4. A note for 452 dollars, payable in 7 months, and grace, is discounted at a bank, when interest is 6 per cent. per annum. What sum is received on it?

VII.

PROFIT AND LOSS.

The ascertaining what is gained or lost in buying and selling, and the adjusting of the price of goods so as to gain or lose a certain sum, or a certain per cent., come under the head of *Profit and Loss.*

1. Bought a piece of broadcloth containing 28 yards for 112 dollars, and sold it at 5 dollars 25 cents a yard. How much, and what per cent., was my profit? (See Percentage, Art. II., Example 22.)

2. Bought 3 pieces of broadcloth, containing 28 yards each, at 5 dollars 25 cents a yard. At what price per yard must I sell it, to gain 20 per cent.?

3. Bought cloth at 4 dollars 60 cents a yard, which, not proving so good as I expected, I sold at 3 dollars 91 cents a yard. What per cent. did I lose?

4. Bought 1250 barrels of flour for 6250 dollars. At what price per barrel must I sell it, to make a profit of 12½ per cent.?

5. Bought wheat at 75 cents a bushel; at what price per bushel must I sell it, to gain 20 per cent.?

6. A merchant received from Lisbon 180 casks of raisins, containing 80$\frac{8}{9}$lb. each, which cost him 2 dollars 18 cents a cask. At what price per cwt. must he sell them, to gain 25 per cent.?

7. If I sell sugar at 8 dollars per cwt., and thereby lose 12 per cent., what per cent. do I gain or lose, by selling the same at 9 dollars per cwt.?

VIII.

PARTNERSHIP.

Partnership is the union of two or more individuals in trade. The company thus associated is called a firm: and the amount of property, which each partner puts into the firm, is called his stock in trade.

When each partner's stock is in the firm an equal length of time, the profit or loss is shared in proportion merely to each one's stock. But when the stock of the several partners is employed unequal terms of time, the profit or loss is shared in proportion both to stock and time.

1. A, B, and C entered into partnership, and the stock of each was in the firm one year. A put in 240 dollars, B 360 dollars, and C 120 dollars. They gained 350 dollars. What was each partner's share of the gain?

Solution. The whole capital $720. A's stock was $240, and he must have $\frac{240}{720}$ of the gain. B's stock was $360, and he must have $\frac{360}{720}$. C's stock was $120, and he must have $\frac{120}{720}$. Observe the following statement.

$\frac{240}{720}=\frac{2}{6}$; and $\frac{2}{6}$ of $350. is 116$\frac{2}{3}$ dollars, A's share.
$\frac{360}{720}=\frac{3}{6}$; and $\frac{3}{6}$ of $350. is 175 dollars, B's share.
$\frac{120}{720}=\frac{1}{6}$; and $\frac{1}{6}$ of $350. is 58$\frac{1}{3}$ dollars, C's share.
$350 Proof.

2. W, S, and L formed a connexion in business. W put into the firm 2500 dollars; S 2000 dollars; and L 1500 dollars. The stock of the several partners was in trade the same term of time, and they gained 1500 dollars. What was each partner's share of the profit?

3. A, B, C, and D traded together one year. A put in 800 dollars, B 500 dollars, C 300 dollars, and D 150 dollars; but by misfortune they lost 350 dollars. What loss did each partner sustain?

4. Three merchants bought a ship, for 8000 dollars. A paid 2850 dollars, B 1980 dollars, and C the rest. In her first voyage she cleared 6400 dollars. How much of the profit had each partner?

When the time is unequal, we compute on the principle, that \$1 for 2 months is equal to \$2 for 1 month For example, A, B, and C traded in company; A put in \$200 for 3 months, B \$180 for 5 months, and C \$70 for 10 months: they gained \$132. Now we say, that A's \$200 for 3 months was the same as \$600 for 1 month; B's \$180 for 5 months the same as \$900 for 1 month; and C's \$70 for 10 months the same as \$700 for 1 month; therefore the relation is the same as if A had put in \$600, B \$900, and C \$700, all for an equal term of time. These sums added together make \$2200; therefore, A had $\frac{600}{2200}$ of the gain, B $\frac{900}{2200}$, and C $\frac{700}{2200}$. These fractions, reduced, are $\frac{6}{22}$, $\frac{9}{22}$, and $\frac{7}{22}$. $\frac{1}{22}$ of \$132 is \$6; then A had 6 times \$6, B 9 times \$6, and C 7 times \$6.

RULE. *Multiply each partner's stock by the time it was in the firm; make each product the numerator of a fraction, and the sum of the products a common denominator; then multiply the whole gain or loss by each of these fractions, for each partner's share.*

5. A, B, and C traded in company. A put in 400 dollars for 9 months, B 300 dollars for 6 months, and C 200 dollars for 5 months: they gained 320 dollars. What was the gain of each?

6. X, Y, and Z formed a partnership. X put into the firm 500 dollars for 18 months, Y 380 dollars for 13 months, and Z 270 dollars for 9 months; but they lost 318 dollars 50 cents. What was the loss of each?

7. Gould and Davis entered into partnership for one year. Gould's stock, at first, was only 500 dollars, but at the end of 5 months he put in 150 dollars more. Davis's stock, at first, was 600 dollars, but at the end of 9 months he took out 200 dollars: at the end of the year, it was found they had gained 682 dollars 50 cents. What was the gain of each partner?

8. Three farmers hired a pasture at 60 dollars 50 cents for the season. A put in 5 cows $4\frac{1}{2}$ months, B 8 cows 5 months, and C 9 cows $6\frac{1}{2}$ months. What rent did each pay?

IX

ASSESSMENT OF TAXES.

Taxes are imposts paid by the people for the support of government. They are assessed on the citizens in proportion to their property; except the poll tax, which is assessed by the head without regard to property.

An inventory of the taxable property of every citizen is the first thing to be obtained by the assessors.

When a tax is on property and polls, we deduct the amount which the polls pay from the sum to be raised, and apportion the remainder according to each man's property.

To effect the apportionment, we find what per cent. of the whole property to be taxed, the sum to be raised is; and if we multiply each man's inventory by that per cent. expressed in decimals, the product is his tax.

Assessors find it more expedient, however, to make a table, which shall exhibit at once the tax on all sums, from $1 up to any amount required. The table is made by multiplying the per cent. which the tax amounts to, by the several numbers, 1, 2, 3, 4, and so on.

The following is a table of taxes to be made when 1½ per cent. is to be raised on the valuation of property.

$1	pays	.015	$20	pay	.30	$200	pay	$3.00
2	"	.03	30	"	.45	300	"	4.50
3	"	.045	40	"	.60	400	"	6.00
4	"	.06	50	"	.75	500	"	7.50
5	"	.075	60	"	.90	600	"	9.00
6	"	.09	70	"	1.05	700	"	10.50
7	"	.105	80	"	1.20	800	"	12.00
8	"	.12	90	"	1.35	900	"	13.50
9	"	.135	100	"	1.50	1000	"	15.00
10	"	.15						

1. By the above table, what would be the tax on $6425 real estate, and $2346 personal estate?

2. By the above table, what would be the tax of a freeholder, whose real estate is valued at $9842, and personal estate, at $15066; poll tax $1.25?

X.

RATIO, PROPORTION,

RULE OF THREE.

Ratio is the mutual relation of two numbers to one another. By finding how many times one number is contained in another, or what part one number is of another, we obtain their ratio. Thus, the ratio of 2 to 4 is 2, because 2 is contained 2 times in 4; and the inverse ratio is $\frac{2}{4}$, because 2 is $\frac{2}{4}$ of 4. Both these expressions of the ratio of 2 to 4 amount to the same thing, which is, that one of the numbers is twice as great as the other.

A ratio is denoted by two dots, similar to a colon: thus, $3:9$ expresses the ratio of 3 to 9. The former term of a ratio is called the *antecedent*, and the latter the *consequent*. Thus, $6:12$ expresses the ratio of 6 to 12, in which 6 is the antecedent, and 12 the consequent.

Since a ratio indicates how many times one number is contained in another, or what part one number is of another, it is a quotient, resulting from the division of one of the terms of the ratio by the other, and may be expressed in the form of a fraction: thus, the ratio 6 . 3 may be expressed by the fraction $\frac{3}{6}$, or conversely $\frac{6}{3}$.

The equality of two ratios is called a Proportion; and the terms are called *proportionals*. Thus, $2:4=3:6$ express a proportion, signifying, that the ratio of 2 to 4 is equal to the ratio of 3 to 6.

In a proportion, the first and fourth terms, that is, the antecedent of the first ratio and the consequent of the second, are called the *extreme* terms; and the second and third terms, that is, the consequent of the first ratio and the antecedent of the second, are called the *mean* terms. Thus, in the proportion $3:9=4:12$, 3 and 12 are the extreme terms, 9 and 4 the mean terms.

It is to be observed that, *if four numbers be in proportion, the product of the extreme terms is equal to the product of the mean terms.*

Since the product of the extremes in every proportion is equal to the product of the means, one product may be taken for the other. Now, if we divide the product of the extremes by one extreme, the quotient is the other extreme; therefore, if we divide the product of the means by one extreme, the quotient is the other extreme.

To apply these principles to practice, let it be asked—If 64 yards of cloth cost 304 dollars, what will 36 yards cost? In the first place, the ratio of the two pieces of cloth is 64 · 36; and secondly, the prices are in the same ratio; that is, 304 dollars must have the same ratio to the price of 36 yards, that 64 yards have to 36 yards. Now, if we put A instead of the answer, we shall have the following proportion, 64 : 36 = 304 : A. Here, the product of the means is 10944, which, divided by 64, one of the extremes, gives the quotient 171, the other extreme, which was the term sought, and the answer.

Of the four numbers in a proportion, two are of one kind, and two of another. In the preceding example, two of the terms are yards, and two are dollars.

From the principles of ratio and proportion, we deduce The Rule of Three—an ancient rule, by the operation of which, having three numbers given, we find a fourth, which has the same ratio to the third that the second has to the first.

RULE OF THREE. *Make the number, which is of the same kind with the answer, the third term. And if, from the nature of the question, the fourth term or answer must be greater than the third term, make the greater of the two remaining terms the second term, and the smaller the first; but, if the fourth term must be less than the third, make the less of the two remaining terms the second term, and the greater the first. Multiply the second and third terms together, and divide the product by the first term: the quotient will be the fourth term, or answer.*

If there are different denominations in the first two terms, they must both be reduced to the lowest denomination in either of them; and the third term must be reduced to the lowest denomination mentioned in it.

Operations corresponding to the Rule of Three have already been taught, in *Relations of Numbers*, Chap. VI. To show the correspondence, suppose it to be asked—If 3 yards of cloth cost 4 dollars, what will 9 yards cost?

In Relations of Numbers, the question stands thus—	In the Rule of Three, the question stands thus—
What is 9 times ⅓ of 4?	3 : 9 = 4 : what number?
3)4	3 : 9 = 4 : A
1⅓	9
9	3)36
12 *Ans.*	12 *Ans.*

1. If I buy 871 yards of cotton cloth for 78 dollars 39 cents, what is the price of 29 yards of the same?

871 : 29 = 78.39 : A
29
70551
15678
871)2273.31(2.61 *Ans.*
1742
5313
5226
871
871

The statements of this question may be read thus—The ratio of 871 to 29 is equal to the ratio of 78.39 to the answer. Or thus—As 871 yd. is to 29 yd., so is $78.39 to the answer. The operation amounts to nothing more than the multiplication of 78.39 by $\frac{29}{871}$.

2. If 1¾ yard of cotton cloth cost 42 cents, what will 87½ yards cost, at the same price per yard?

1.75 : 87.5 = .42 : A

3. If I can buy 1¼ yard of cotton cloth for 6¼ pence, how many yards can I buy for £10 6s. 8d.?

6d. 1qr. : £10 6s. 8d. = 1yd. 1qr. : A

4. If I buy 54 barrels of flour for 297 dollars, what must I give for 73 barrels, at the same rate?

5. If 7 workmen can do a piece of work in 12 days, how many can do the same work in 3 days?

6. If 20 horses eat 70 bushels of oats in 3 weeks, how many bushels will 6 horses eat in the same time?

7. If a piece of cloth containing 76 yards cost 136 dollars 80 cents, what is that per ell English?

8. If a staff 4 feet long cast a shadow 7 feet in length, on level ground, what is the height of a steeple, whose shadow at the same time measures 198 feet?

9. How many yards of paper, $2\frac{1}{2}$ feet wide, will hang a room, that is 20 yards in circuit, and 9 feet high?

10. A certain work having been accomplished in 12 days, by working 4 hours a day, in what time might it have been done by working 6 hours a day?

11. If 12 gallons of wine are worth 30 dollars, what is the value of a cask of wine, containing $31\frac{1}{2}$ gallons?

12. If $8\frac{3}{4}$ yards of cloth cost 4 dollars 20 cents, what will $13\frac{1}{2}$ yards cost, at the same rate?

13. How many yards of cloth $\frac{3}{4}$ yard wide, are equal to 30 yards $1\frac{1}{4}$ yard wide?

14. If 7 pounds of sugar cost 75 cents, how many pounds can I buy for 6 dollars?

15. If 2 pounds of sugar cost 25 cents, and 8 pounds of sugar are worth 5 pounds of coffee, what will 100 pounds of coffee cost?

16. A merchant owning $\frac{4}{5}$ of a vessel, sold $\frac{2}{3}$ of his share, ($\frac{4}{5} \times \frac{2}{3}$,) for 957 dollars. What was the vessel worth, at that rate?

17. A merchant failing in trade, owes 62936 dollars 39 cents; but his property amounts to only 38793 dollars 96 cents, which his creditors agreed to accept, and discharge him. How much does the creditor receive, to whom he owes 2778 dollars 63 cents?

18. Bought 3 tons of oil, for 503 dollars 25 cents; 85 gallons of which having leaked out. I wish to know at what price per gallon I must sell the residue, that I may neither gain nor lose by the bargain.

19. If, when the price of wheat is 6s. 3d. a bushel, the penny loaf weighs 9 oz., what ought it to weigh, when wheat is at 8s. $2\frac{1}{2}$d. a bushel?

20. If 15 yards of cloth $\frac{3}{4}$ yard wide cost 6 dollars 25 cents, what will 40 yards, being yard wide, cost?

21. Borrowed of a friend 250 dollars for 7 months; and then, to repay him for his kindness, I loaned him 300 dollars. How long must he keep the 300 dollars, to balance the previous favor?

22. If 4½ cwt. be carried 36 miles for $ 5½, how many pounds can be sent 20 miles for the same money?

23. A person owning ⅗ of a coal mine, sells ¾ of his share for 570 dollars. What is the whole mine worth?

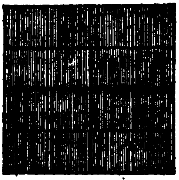
24. If the discount on $ 106, for a year, be $6, what is the discount on $477, for the same time?

XI.

MEASUREMENT

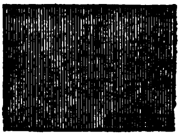
OF SURFACES, SOLIDS AND CAPACITIES.

It has already been taught, that surfaces are measured in squares, and, that solid bodies are measured in cubes.



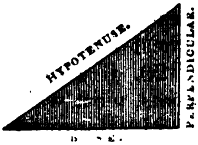
A **SQUARE** is a figure, that has four equal sides, and four equal angles. Its angles are called *right* angles: angles more pointed are called *acute* angles; and those less pointed, *obtuse* angles. To find the area of a square, in smaller squares—*Multiply one side into itself.*

1. How many square feet are there in a table that measures 4 feet on every side? How many square inches?



A **PARALLELOGRAM** is a four-sided figure, having opposite sides equal, and having four right angles. To find the area of a parallelogram—*Multiply the length into the breadth.*

2. How many square rods in a garden measuring 4 rods in length, and 3 in breadth? How many square feet?

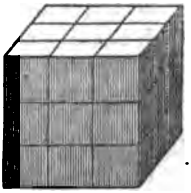


A **TRIANGLE** is a figure, that has three sides and three angles. A triangle, which has one right angle, is called a **RIGHT-ANGLED TRIANGLE.** To find the area of a right-angled triangle—*Multiply the base by half the perpendicular.*

3. How many square rods are there in a right-angled triangular field, measuring 98 rods on the base, and 75 rods on the perpendicular? How many acres?

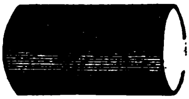
A **CIRCLE** is a plane surface, bounded by one curve line, called the *circumference*. The diameter being known, to find the circumference—*Multiply the diameter by* 3.14159. Then, to find the area—*Multiply half the circumference by half the diameter.*

4. How many square inches are there in the head of a barrel, the diameter of which measures 17 inches?



A **CUBE** is a regular solid body, having six equal, square sides. To find its contents in smaller cubes—*Multiply the breadth of a side twice into itself.* The product of the length, breadth, and thickness is the contents of any thing, whose opposite sides are equal.

5. How many cubic inches are there in a box measuring 34 inches in length, 26 in width, and 18 in depth?



A **CYLINDER** is a round body, with equal, circular ends. To find its cubical contents—*Find the area of one end, and multiply this by the length.*

6. How many cubic inches are there in a drum measuring 16 inches across the head, and 18 inches in length?

PLASTERING AND PAVING are charged by the square yard. Their surface is first found in square feet, and then reduced to square yards.

7. How many square yards of plastering in the ceiling and four sides of a room, that is 15 feet long, 12 feet wide, and 10 feet high; deducting two doors, 7 by 4 feet each, and four windows, 5 by $3\frac{6}{12}$ feet each?

8. How many bricks are required to pave a cellar, that is 48 feet long and 30 feet wide; allowing each brick to be 8 inches long, and 3.8 inches wide? Here find the area of the cellar in square inches, and divide it by the square inches in the area of a brick.

SHINGLES AND CLAPBOARDS are of various dimensions. Therefore, to know how many are requisite to cover a building, we find the number of square inches in the roof or side to be covered, and divide this number by the number of square inches, that one shingle or clapboard will cover.

9. If shingles 4 inches in width be laid so that 6 inches of their length is exposed to the weather, how many are required to cover a roof 45 by 32 feet?

10. How many clapboards, each covering 46 by 4 inches, are sufficient for the side of a house 45 by 22 feet?

BOARDS are sold by the thousand square feet, and each board is measured thus—*Multiply the length in feet by the width in inches, and divide the product by* 12; *the quotient will be square feet.*

11. How many square feet are there in 17 boards, each board being 21 feet long, and 18.5 inches wide?

12. How many square feet of boards will floor a room 14 by 18 feet, allowing $\frac{1}{10}$ of the stuff for waste?

PLANK AND JOIST are measured by finding how many square feet of boards, one inch in thickness, they are equal to. Therefore—*Multiply the length in feet by the width in inches, and this product by the depth in inches; then divide the last product by* 12, *for the square feet.*

13. How many square feet in a plank that is 9 feet in length, 14 inches in width, and 2.4 inches in depth?

14. How many square feet in a joist that is 13 feet long, 4 inches wide, and 8.2 inches deep?

TIMBER is sold by the cubic ton. To measure hewn timber—*Multiply the length in feet by the width in inches, and this product by the depth in inches; divide by* 144, *for the cubic feet, and then by* 50 *for the tons.*

To measure round timber—*Take the circumference in inches, by girding the log, one-third of the way from the but to the top; then multiply the length in feet, by the square of* $\frac{1}{4}$ *of the circumference; divide by* 144 *for the cubic feet, and then by* 40 *for the tons.*

15. How much hewn timber in a stick measuring 25 feet in length, 19 inches in width, and 20 inches in depth?

16. How much round timber in a log, 30 feet long, and 55 inches in circumference?

CELLARS, WELLS, and other pits, are measured by the cube of six-feet side; and this cube is called a SQUARE OF EARTH. To measure a cellar—*Add together the depth of the four corners, divide the sum by 4, multiply the quotient by the length, and this product by the width, all in feet, for the cubic feet; then divide by* 216 *for the squares.*

To measure a well—*Proceed as with a cylinder to find the cubic feet, and divide by* 216 *for the squares.*

17. How many squares in a cellar, the length being 30 ft., width 22 ft., depth at corners, 12 ft., 9 ft., 7 ft., and 4 ft.?

18. At $1.08 a square, what is to be paid for digging a well, 60 feet deep, and 8 feet in diameter?

STONE WALLS are measured by the *perch*, of 24¾ cubic feet. To measure a straight wall—*Multiply, in feet, the length by the height, and this product by the thickness, for the cubic feet; then divide by* 24.75 *for the perches.*

To measure a circular wall—*Take the diameter, to the centre of the thickness of the wall, and compute the circumference, in feet. Then multiply the circumference height, and thickness together, all in feet, for the cubic feet, and divide by* 24.75, *for the perches.*

19. How much wall, of 2 feet thickness, and 8 feet height, in a cellar measuring 36 feet on every side within the clear?

20. How much wall in a well 40 feet deep; the wall being 2 feet thick, and the diameter being 4.5 feet?

BINS, BOXES, &c., holding commodities sold by the gallon or bushel, are measured thus—*Find the contents in cubic inches, as already taught; then divide by* 231 *for wine gallons, or, by* 2150.4 *for bushels.*

21. How many gallons in a vat, measuring 60 inches in length, 36 inches in breadth, and 72 inches in depth?

22. How many bushels of grain in a bin, 84 inches in length, 32 inches in breadth, and 48 inches in depth?

CYLINDRIC VESSELS, such as tubs and cisterns for holding water, are measured thus—*Multiply, in inches, the diameter of one end into itself, and this product into the height; then divide by* 294 *for the wine gallons.*

If the ends of the vessel be unequal—*Multiply the greater diameter by the less, and to the product add $\frac{1}{3}$ of the square of their difference; multiply this sum by the height, and divide by 294, for the gallons.*

23. How many gallons will a tub hold, the diameter of which is 18 inches, and the height 22 inches?

24. How many gallons of water will a cistern hold, measuring 72 inches across the bottom, 60 inches across the top, and 84 inches in height?

THE CAPACITY OF CASKS is found as follows—*Take the interior dimensions as nearly as possible. Subtract the diameter of the head from the diameter at the bung. Multiply the difference by .7, if the staves be* MUCH *curved; or by .6, if* LITTLE *curved; or by .65, if they be of* MEDIUM *curve. Add the product to the head diameter, and the sum will be the mean diameter. Square the mean diameter; multiply the square by the length of the cask, and divide this product by 294, for wine gallons.*

25. Find the number of gallons in a cask of medium curve, 47 inches in length, 31 inches diameter at the bung, and 26 inches diameter at the head.

26. What is the capacity of a cask, much curved, measuring 32.5 inches in length, 19 inches at the bung, and 15.4 inches at the head?

XII.

DUODECIMALS.

DUODECIMALS are compound numbers, the value of whose denominations diminishes in a uniform ratio of 12. They are applied to square and cubic measure.

The denominations of duodecimals are the foot, (*f.*), the prime or inch, ($'$), the second, ($''$), the third, ($'''$), the fourth, ($''''$), the fifth, ($'''''$), and so on. Accordingly, the expression, $3\ 1'\ 7''\ 9'''\ 6''''$ denotes 3 feet 1 prime 7 seconds 9 thirds 6 fourths.

The accents, used to distinguish the denominations below feet, are called *indices*.

The foot being viewed as the unit, duodecimals present the following relations.

$1' = \frac{1}{12}$ of 1 foot.
$1'' = \frac{1}{12}$ of $\frac{1}{12}$ of 1 foot. . . . . $= \frac{1}{144}$ of 1 foot.
$1''' = \frac{1}{12}$ of $\frac{1}{12}$ of $\frac{1}{12}$ of 1 foot. . . $= \frac{1}{1728}$ of 1 foot.
$1'''' = \frac{1}{12}$ of $\frac{1}{12}$ of $\frac{1}{12}$ of $\frac{1}{12}$ of 1 foot. $= \frac{1}{20736}$ of 1 foot.
&c.

Addition and subtraction of duodecimals are performed as addition and subtraction of other compound numbers; 12 of a lower denomination making one of a higher. Multiplication, however, when both the factors are duodecimals, is peculiar, and will now be considered.

When feet are multiplied by feet, the product is in feet. For instance, if required to ascertain the superficial feet in a board 6 feet long and 2 feet wide, we multiply the length by the breadth, and thus find its superficial, or square feet to be 12. But when feet are multiplied by any number of inches, [primes], the effect is the same as that of multiplying by so many twelfths of a foot, and therefore the product is in twelfths of a foot, or inches Thus a board, 6 feet long and 6 inches wide, contains 36 inches, because the length being multiplied by the breadth, that is, 6 feet by $\frac{6}{12}$ of a foot, the product is $\frac{36}{12}$ of a foot, or $36' = 3$ feet. When feet are multiplied by seconds, the product is in seconds. Thus 6 feet multiplied by 6 seconds, that is, $\frac{6}{1}$ of a foot by $\frac{6}{12}$ of $\frac{1}{12}$ of a foot the product is $\frac{36}{144}$ of a foot, or $36'' = 3$ inches.

Feet multiplied by feet, produce feet.
Feet multiplied by primes, produce primes.
Feet multiplied by seconds, produce seconds.
Feet multiplied by thirds, produce thirds.
&c.
Primes multiplied by primes, produce seconds
Primes multiplied by seconds, produce thirds.
Primes multiplied by thirds, produce fourths.
&c.
Seconds multiplied by seconds, produce fourths
Seconds multiplied by thirds, produce fifths.
Seconds multiplied by fourths, produce sixths.
&c.

If we would find the square feet in a floor 6 f. 4′ 8″ in length, and 4 f. 6′ 5″ in breadth, we proceed as follows.

		6 f.	4′	8″
		4	6′	5″
	2′	7″	11‴	4⁗
3	2′	4″	0‴	
25	6′	8″		
28 f.	11′	7″	11‴	4⁗

We begin on the right hand, and multiply the whole multiplicand, first by the seconds in the multiplier, then by the inches, and lastly by the feet. We then add the results together, and thus obtain the answer.

We are now led to a general rule for the multiplication of duodecimal numbers.

RULE. *Place the several terms of the multiplier under the corresponding ones of the multiplicand. Beginning on the right hand, multiply the several terms of the multiplicand by the several terms of the multiplier successively, placing the right hand term of each of the partial products under its multiplier. Then add the partial products together; observing to carry one for every twelve, both in multiplying and adding. The sum of the partial products will be the answer.*

Questions in duodecimals are very commonly performed by commencing the multiplication with the highest denomination of the multiplier, and placing the partial products as in the first of the two following operations. The result is the same, whichever method is adopted. The second operation, however, is according to the rule we have given, and is more conformable to the multiplication of numbers accompanied by decimals.

3 f.	2′	7″		
2 f.	6′	4″		
6	5′	2″		
1	7′	3″	6‴	
	1′	0″	10‴	4⁗
8 f.	1′	6″	4‴	4⁗

		3 f.	2′	7″
		2 f.	6′	4″
	1′	0″	10‴	4⁗
1	7′	3″	6‴	
6	5′	2″		
8 f.	1′	6″	4‴	4⁗

When there are not feet in both the factors, there may not be any feet in the product; but, after what has been said, there will be no difficulty in determining the places of the product.

1. Multiply 14f. 9′ by 4f. 6′.

2 What are the contents of a marble slab, whose length is 5f. 7′, and breadth 1f. 10′?

3. How many square feet are there in the floor of a hall, 48f. 6′ long, and 24f. 3′ wide?

4. Multiply 4f. 7′ 8″ by 9f. 6′.

5. How many square feet are there in a house lot, 43f. 3′ in length, and 25f. 6′ in breadth?

6. What is the product of 10f. 4′ 5″ by 7f. 8′ 6″?

7. Calculate the square feet in an alley 44f. 2′ 9″ long, and 2f. 10′ 3″ 2‴ 4⁗ wide.

8. How many square feet are there in a garden, 39f. 10′ 7″ long, and 18f. 8′ 4″ wide?

9. What is the product of 24f. 10′ 8″ 7‴ 5⁗ by 9f. 4′ 6″?

10. Compute the solid feet in a wall, 53f. 6′ long, 12f. 8′ high, and 2f. thick.

1 The length of a room is 20 feet, its breadth 14 feet
6′ 10f. 4′. How many yards of painting
ting a fire place of 4f. by 4f.
3f. 2′?...
wide, will be

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$$\begin{array}{lllll}
3\text{f.} & 2' & 7'' & & \\
2\text{f.} & 6' & 4'' & & \\
\hline
6 & 5' & 2'' & & \\
1 & 7' & 3'' & 6''' & \\
 & 1' & 0'' & 10''' & 4'''' \\
\hline
8\text{f.} & 1' & 6'' & 4''' & 4''''
\end{array}
\qquad
\begin{array}{lllll}
 & 3\text{f.} & 2' & 7'' & \\
 & 2\text{f.} & 6' & 4'' & \\
\hline
 & 1' & 0'' & 10''' & 4'''' \\
1 & 7' & 3'' & 6''' & \\
6 & 5' & 2'' & & \\
\hline
8\text{f.} & 1' & 6'' & 4''' & 4''''
\end{array}$$

When there are not feet in both the factors, there may not be any feet in the product; but, after what has been said, there will be no difficulty in determining the places of the product.

EMERSON'S SECOND PART.

Williams College, Oct. 29, 1832.

To Mr. Frederick Emerson. Sir,—I have received the First and Second Parts of your North American Arithmetic; and am highly pleased with the plan of the work, and the manner of its execution thus far. It unites simplicity with fulness, and will thus be sure to interest the beginner, whilst [illegible] furnishes, at the same time, an ample guide to the more advanced pupil.

Respectfully and truly yours, ALBERT HOPKINS.

[*Professor of Mathematics and Nat[illegible] Philosophy in Williamstown Coll[illegible]*]

Union College, Schenectady, Feb. 8th, 1832.

Mr. F. Emerson. Sir,—I have received the First and Second Parts of the North American Arithmetic, and examined them with pleasure. The relations of numbers are happily illustrated by the relations of sensible objects. This renders the work more entertaining and instructive, especially at that age to which arithmetic is better adapted than many of those studies which the want of a system like this are too often introduced. Here the student will acquire not merely rules to [illegible] hand, but principles to enlighten his understanding. [illegible] furnished with a [illegible] skill for grinding numbers [illegible] a certain result under given [illegible].

I am, sir, respectfully, your ob't ser't, B. JOSLIN.

[*Professor of Mathematics and Natural Philosophy in Union College.*]

Burlington, 15th February, 1832.

[*Conclusion of a Letter to the Author.*] I should think it hardly possible that a child could be faithfully conducted through these two works, [*First and Second Parts*], without being vastly better acquainted with the subject than children formerly were. Being continually compelled, in many instances, to invent their own rule, they can scarcely fail of being able to assign a proper reason for the process, as well as to recollect it for future [illegible]. Indeed, I do not know any one particular in which, for [illegible] of very young pupils, they could be improved. Yours respectfully,

JAMES DEAN.

[*Professor of Mathematics and Natural Philosophy, in the University of Vermont.*]

Athens, O., February the 1st, 1832.

Mr. Emerson. Dear Sir,—I have carefully and attentively examined the "First and Second Parts" of "The North American Arithmetic;" and can say, with pleasure, that the work meets my unqualified approbation. You have, perhaps, rendered [illegible] highly interesting to the youthful mind as the nature [illegible] subject will admit. Your method of illustrating the [illegible] principles of [illegible] is clear, familiar, and [illegible] of its adaptation to the minds of youth.

I am, yours, &c. WILLIAM WALL.

[*Professor of Mathematics, in the Ohio University.*]